

THE MEDIUM IS THE METHOD: MODELING STRATEGIES FOR SPATIO-TEMPORAL EVENTS

by Omar Khan

Bachelor of Architecture(BArch)
Cornell University
May 1992

Submitted to the Department of Architecture
School of Architecture and Planning at MIT
in Partial Fulfillment of the Requirements for the degree of
Master of Science in Architecture Studies(SMArchS)
at the Massachusetts Institute of Technology
June 2001

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THE MEDIUM IS THE METHOD: MODELING STRATEGIES FOR SPATIO-TEMPORAL EVENTS

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Abstract:

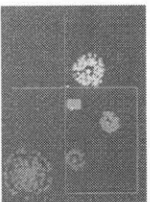
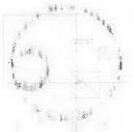
In an increasingly networked environment, time has become synonymous with place. The amount of time allocated to an activity serves as the boundary between one space and another. So that where we once had places called home and work, now we have times that define that boundary. Within this context an architectural study of temporal events and the means of representing them is critical.

What is the architecture of a temporal event? How can one describe it, inquire into it, design for it? This thesis looks into the possibility of using the medium as a method for addressing these questions. Three mediums, the narrative, the video camera, and computation have been chosen to develop techniques for studying a dynamic phenomenon. All three have time as a distinct component of their expression. The event is "a woman watering a plant", which has a time lapse of 19 seconds. The media and their techniques were the means to represent it, study it and re-fabricate it.

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To Peter Testa and Devyn Weiser for their advise and encouragement.

And finally to Laura, the star of this thesis, who put up with the filming, writing, editing, and late nights needed to bring it all together.

action Montage
19:00 sec

relation Montage
19:00 sec

relation Shot
19:00 sec

action Shot
19:00 sec

Simulation I
19:00 sec



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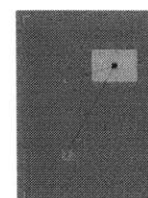
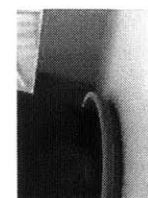
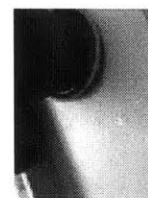
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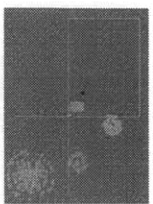
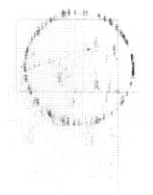
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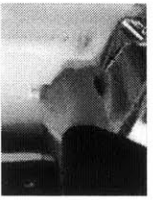
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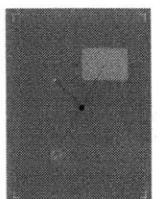
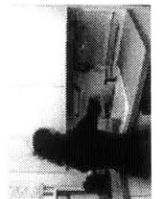
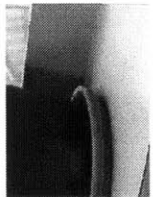
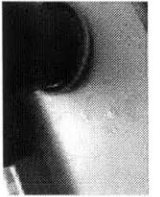
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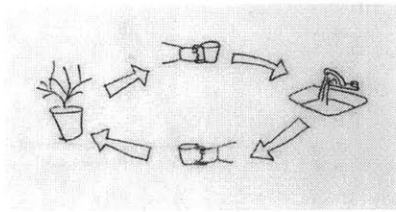




I. INTRODUCTION







Event process diagram

The scene goes as follows: a woman fills a cup with water, takes it to a plant and empties it into the plant's pot. She returns to the faucet to refill the cup. This simple scenario is the basis for an experiment in architectural space-making. It is the site for the thesis, which develops conceptual models that theorize that space-making is a dynamic phenomenon. The experiment relies on the medium of expression to provide the methods for investigation. The media chosen for the experiment are written narrative, video, and computation.

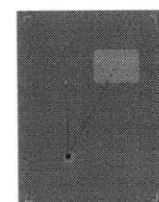
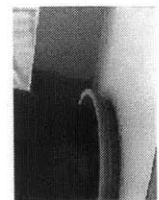
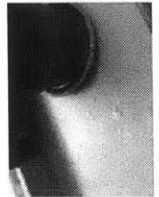
It is necessary here to make a distinction between traditional media like paint, ink and wood and technological media like cameras and computers. In the former, the desired effect results from controlled physical actions upon the media, so that the motion of the hand has a direct effect on what the pencil will draw. In technological media the effect is a result of an operation that the physical body has given over to a mechanism, so that a camera can produce a photograph with as little bodily intervention as pressing a button. This thesis is interested in giving over to the process of the mechanism. How do its methods and operations (whether they be digital or analogical) effect what we perceive? How can we let the medium guide us in thinking about and designing for space?

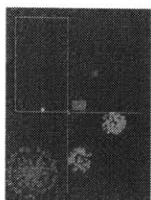
The Models and Methods:

The models that this thesis will develop solicit media that have time as an explicit component of their expression. Explicit use of the methods and techniques of these media require borrowing from anthropological writing, cinema, and computer science.

Description Space:

The written narrative creates description space. Its medium is words that construct space in the reader or listener's mind through the act of reading or telling. This makes each instantiation of

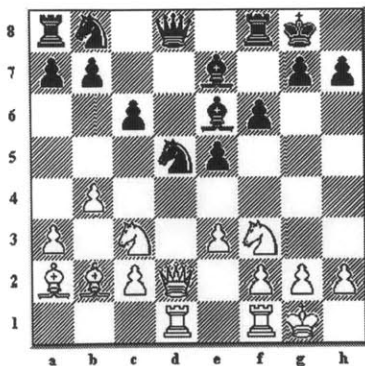
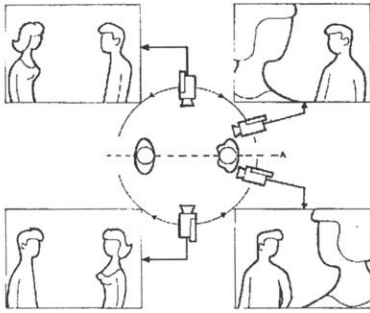




IN A STATION OF THE METRO

The apparition of these faces in a crowd;
Petals on a wet, black bough.

-Ezra Pound



this space unique because it borrows its characteristics from each reader/listener's personal experience and imagination.

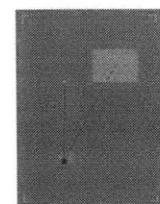
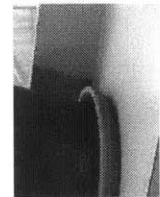
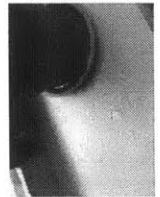
Time in a narrative occurs in two different ways, one in the duration of its reading or telling and the other in the story's internal time as set by the author. Playing with these two temporal conditions of the narrative a series of experiments, following a methodology for "thickening" the description were carried out.

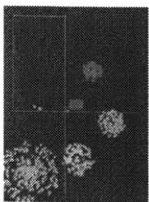
Camera Space:

Camera Space is the depiction of space through a camera's lens. Its medium is the cinematic image which is constructed through cinematic camera techniques that are part of the cameraman's repertoire. A partial list includes: the close-up, the long shot, the pan, the moving shot and the traveling shot. Although this thesis will use a limited number of these techniques, this in no way implies a proscription on the inclusion of other camera techniques. Camera space introduces two important concepts: the frame and the point of view. The frame describes the boundary of the view, while the point of view (POV) defines the position or angle from which a person observes. This position can be measured. At the same time, it can also suggest a person's psychological framework while observing an event. In this way it deals with both the mechanical and experiential aspects of seeing.

Game Space:

Game space is the space of simulation. A simulation is a "dynamic representation which employs substitute elements to replace real or hypothetical components" (Gibbs, p. 8). A simulation helps to formulate the "big picture" by establishing a multi-logue (multiple, simultaneous dialogue) between its components (Duke, p.23). It also can entertain other scenarios that might occur between components. Two concepts that will be instrumental in the work are "mutability" and "interaction". The gaming space's mutability results from the fact





that it is a digital artifact (a program) that exists in the computer's memory. As such it can be altered by changing its code or by making provisions in the code for external inputs or random operations. Interaction, suggests the ability for a person to input data through a variety of input devices (keyboard, mouse, voice etc.) into the program to elicit responses.

The Event:

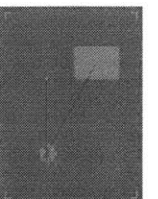
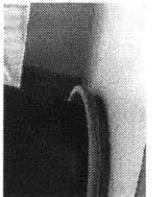
An event is the result of objects interacting with one another in a very particular way, so that if those interactions are maintained the event would continue to occur.

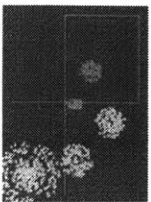
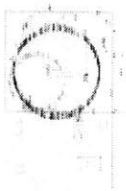
The difficulty of talking about the space of a temporal event can be seen from the following example: "A woman watering a plant" occurs in a space that could be described as a "kitchen". However, if the plant were placed in another room, we would say that the event occurred in an apartment or house. Static architectural programs, kitchen, apartment, house, are arbitrary frames of reference because they are not partial to the event. That is to say that the kitchen serves as a space for many other events and not exclusively for "a woman watering a plant." The quest for more precise definitions of a temporal event's space will require space to become more like time: dynamic and evolving.

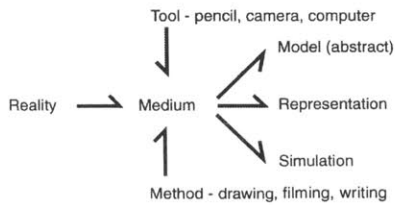
An event contains objects whose interactions form it. These active objects are the event's components. "A woman watering a plant" has five components: a woman, a cup, a faucet, water and a plant. Only if these components play a particular role will the event occur.

The Medium is the Method:

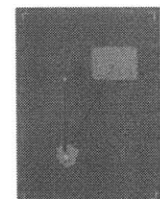
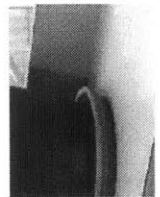
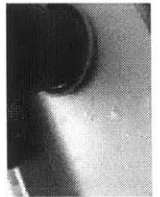
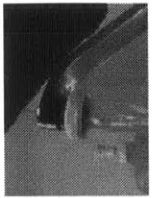
This rewriting of Marshall McLuhan's mantra "the medium is the message", is intended as a cautionary directive for using digital tools and techniques in the creative process. The architect's digital tool set now includes many applications that weren't

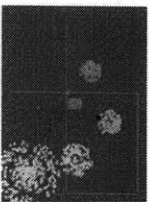
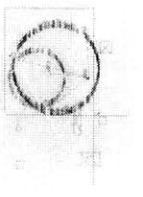
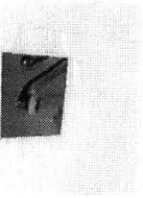






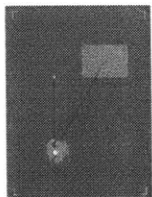
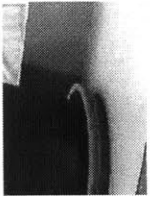
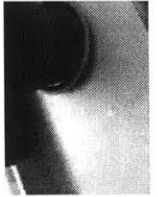
specifically developed for architecture. These include image software like Photoshop, and animation software like 3-D Studio Max and Maya. Techniques of these tools have consumed recent architectural production. The sculptural forms of Frank Gehry, and the “animate” forms of Greg Lynn, are attributed by their creators to the affordances of these new digital tools. However this emphasis on the products of the tools rings similar to McLuhan’s claim that “the content of a medium blinds us to the character of the medium.” (McLuhan, *Understanding Media*, p.9). The effects of the medium on our perception of space is passed aside for the mechanical affordances of the tool, that is, now we can do what we used to do manually only faster and more accurately. If we make the medium an integral part of our design methods we are forced to move beyond mere affordances. As this research will argue the medium should suggest the methods. These methods are a *modus operandi* that create a frame of reference instigated by the artist and mediated by the medium. Theorizing and making go hand-in-hand. Decisions are made by giving control over to the medium, and then post-rationalizing the results. The role of intention is deferred momentarily because method and effect are not necessarily the same thing. Effect comes from understanding, while method results from experimenting. Finally, by placing the responsibility of method onto medium, the act of making takes on great significance. It is important to stress that a playful attitude towards making is necessary where the constraints are defined only by the medium.

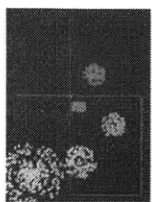






II. DESCRIPTION SPACE

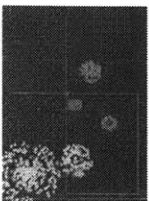




Narrative as medium: "Thick Descriptions"

Clifford Geertz in *The Interpretation of Cultures* describes the work of ethnography as fabricating "thick descriptions". Giving the example of three boys all twitching their right eyelid, he explains that a "thin description" of the event would be boy1 "rapidly contracting his right eyelid", boy2 "rapidly contracting his right eyelid", boy3 "rapidly contracting his right eyelid". This "phenomenalistic" or "I-am-a-camera" observation suggests that all three are engaged in the same activity. However, if it comes to be known that boy1 is actually involuntarily twitching, while boy2 is winking in order to give signals to a friend and boy3 is parodying boy2, making fun of his clumsy winking, the equality of the phenomenon is lost. It is in the "thick description" of the activity, Geertz writes, "lies the object of ethnography: a stratified hierarchy of meaningful structures in terms of which twitches, winks, fake-winks, parodies, rehearsals of parodies are produced, perceived, interpreted and without which they would not (not even the zero-form twitches, which as a cultural category, are as much nonwinks as winks are nontwitches) in fact exist, no matter what anyone did or didn't do with his eyelids." (Geertz, *The Interpretation of Cultures*, p. 7).

Geertz goes on to suggest that the analysis of cultural events, that is "sorting out the structures of signification", begins with the understanding that culture does not exist in the mind and hearts of people but is an "acted document" that exists in "public". The job of the ethnographer is to interpret this document through conversation with those("actors") that collectively form it. The result is anthropological texts, which Geertz says are "fictions in the sense that they are "something made", "something fashioned"- the original meaning of fictio-not that they are false, unfactual, or merely "as if" experiments." (Geertz, p. 15) Their validity as an objective form of knowledge is threatened by the realization that "the line between mode of representation [writing in this case] and substantive content is as un-drawable in cultural analysis as it is in painting." (Geertz, p.



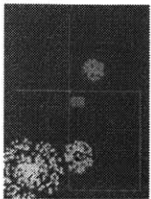
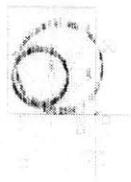
16) However, Geertz concludes, it is precisely in this indeterminacy that its virtue lies, that is, how do you tell a "better account from a worse one." He writes, "if ethnography is thick description and ethnographers those who are doing the describing, then the determining question for any given example of it, whether a field journal squib or a Malinowski-sized monograph, is whether it sorts winks from twitches and real winks from mimicked ones. It is not against a body of uninterpreted data, radically thinned descriptions, that we must measure the cogency of our explications, but against the power of the scientific imagination to bring us into touch with the lives of strangers." (Geertz, p. 16).

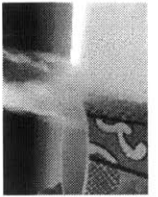
Description space is the space of narrative. Because we are dealing with an event that plays itself out in time and space, the narrative must be able to communicate the timely nature of what it describes. The narrative embodies time in two ways: one in the duration of its telling or reading, and the other in communicating the measured time (minutes, hours, days) of the events it is describing. Using the medium of the narrative, an experiment was fashioned that plays with its time of telling while keeping its internal clock constant.

It does this through a process of thickening the description. At each step, it sets up clear rules and executes them across the description. The resulting description becomes the artifact upon which the next rule is launched. This strict iterative method was set up to create a structure that would guide the process as well as provide the means for retracing one's steps.

The Description Space of the Event:

The first step was to describe the event simply as a sequence of "actions". This would help in defining what constituted the "beginning" and the "end" of the event. It would constitute the temporal boundaries of the event and, following our initial assumption, its spatial boundaries:

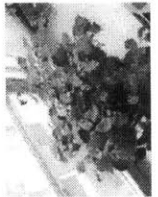




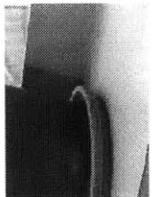
"A WOMAN PLACES A CUP UNDER A FAUCET, OPENS THE FAUCET AND FILLS THE CUP WITH WATER. SHE TAKES THE FILLED CUP TO THE PLANT AND EMPTIES THE WATER INTO THE PLANT'S POT. SHE RETURNS TO THE FAUCET AND REFILLS THE CUP."

10 0
12 19

The event begins with a woman placing a cup underneath a faucet and ends when she returns to repeat the activity. It concentrates on the sequence of performed actions and therefore can be seen as a description of process: do a --> do b --> do c --> do a . . . While trying to write this description I realized I had to edit out of it any references that might alter its reading as "process". Details like names, colors, thoughts, emotions were filtered out to yield a precise but "thin" description. The description's internal time is 19sec, while its reading time is 12 sec. This measured difference alters with each iteration.

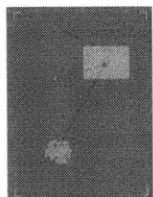


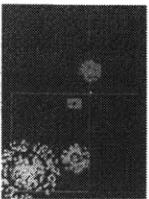
The series of word additions that follow try to thicken the description, while maintaining the beginning, middle, and end of the event in their relative positions. The thickening consisted of literally inserting into each description, further descriptions. The first iteration was of "location" that resulted in the following description:

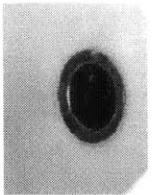


A WOMAN {standing in front of a kitchen sink with a dishwasher to her right, and wall cabinets above} PLACES A CUP {in her left hand} UNDER A FAUCET {attached to the sink with dish washing liquid to the left of it, a paper towel roll above it and a dish rack to the right of it, an under-counter cabinet below it}, OPENS THE FAUCET {attached to the sink with dish washing liquid to the left of it, a paper towel roll above it and a dish rack to the right of it, an under-counter cabinet below it} AND FILLS THE CUP {in her left hand} WITH WATER. SHE TAKES THE FILLED CUP {in her right hand} TO {passing the stove to her right} THE PLANT {sitting on the countertop in front of a window, with the refrigerator in front of it, a spice rack to the right of it, a wire rack mounted to the wall with tea and honey to the left of it and a shelving unit with bowls and trays underneath it} AND EMPTIES THE WATER {placing the cup in her left hand above the plant} INTO THE PLANT'S POT. SHE RETURNS {passing the stove on her left} TO THE FAUCET {attached to the sink with dish washing liquid to the left of it, a paper towel roll above it and a dish rack to the right of it, an under-counter cabinet below it} AND REFILLS THE CUP {in her left hand}.

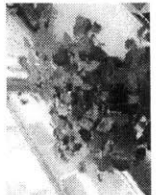
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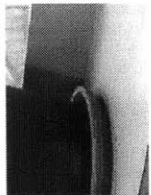


Location tries to physically place the event's objects in relation to other objects. It does this by querying which objects are to the left, right, back, front, above and below this object. Besides adding new objects to the event it does bring out some facts like the cup being in the left hand, and the plant being on the countertop in front of a window. These facts contribute to our understanding the relationship between objects: cup to hand, cup to plant. The next iteration was of "materiality":



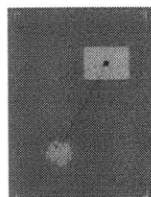
A WOMAN (**dressed in a hip length sweater and corduroy pant and black leather bottom shoes**) {standing in front of a (**porcelain covered cast iron**) kitchen sink with a dishwasher to her right, and (**compression board**) wall cabinets above} PLACES A (**porcelain**) CUP {in her right hand} UNDER A (**stainless steel**) FAUCET {attached to the (**porcelain covered cast iron**) sink with (**blue**) dish washing liquid to the left of it, a paper towel roll above it and a (**stainless steel**) dish rack to the right of it, an (**compression board**) under-counter cabinet below it}, OPENS THE (**stainless steel**) FAUCET {attached to the (**porcelain covered cast iron**) sink with (**blue**) dish washing liquid to the left of it, a paper towel roll above it and a (**stainless steel**) dish rack to the right of it, an (**compression board**) under-counter cabinet below it} AND FILLS THE (**porcelain**) CUP {in her right hand} WITH (**cold**) WATER. SHE TAKES THE FILLED (**porcelain**) CUP {in her right hand} TO {passing the stove to her right} THE PLANT {sitting on the (**turquoise Formica**) countertop in front of a (**double-hung wooden**) window, with the (**white**) refrigerator in front of it, a (**stainless steel**) spice rack to the right of it, a (**plastic covered**) wire rack mounted to the wall with (**green and fruit**) tea and (**dark brown**) honey to the left of it and a (**compression board**) shelving unit with (**glass, metal and ceramic**) bowls and (**metal**) trays underneath it} AND EMPTIES THE (**cold**) WATER {placing the (**porcelain**) cup in her right hand above the plant} INTO THE PLANT'S (**terra-cotta**) POT. SHE RETURNS {passing the (**black front white top**) stove on her left} TO THE (**stainless steel**) FAUCET {attached to the (**porcelain covered cast iron**) sink with (**blue**) dish washing liquid to the left of it, a paper towel roll above it and a (**stainless steel**) dish rack to the right of it, an (**compression board**) under-counter cabinet below it} AND REFILLS

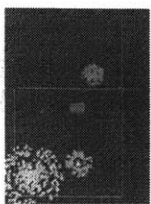
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THE (**porcelain**) CUP {in her right hand}.

Materiality tries to create specificity in the objects, so that the cup isn't any cup but a "porcelain" cup.

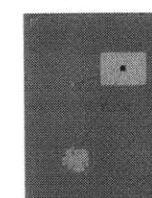
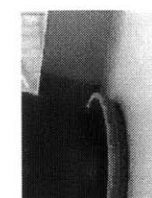
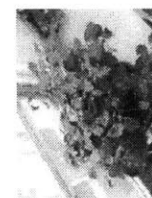
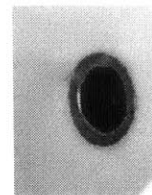


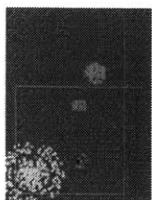


The third iteration was of "identity":

A WOMAN [Laura, who has painstakingly cared for her houseplants] (dressed in a hip length sweater and corduroy pant and black leather bottom shoes){standing in front of a (porcelain covered cast iron) kitchen sink [that can be only properly cleaned with bleach] with a [newly replaced] dish-washer to her right, and (compression board) wall cabinets [containing square dishes, bowls, glasses and mugs] above} PLACES A (porcelain) CUP [a coffee mug, that her mother gave her and of which only two are left since the others have broken] {in her left hand} UNDER A (stainless steel) FAUCET [that leaked but was recently fixed by the plumber but since has developed a new problem of not releasing water if its lever is too quickly pushed] {attached to the (porcelain covered cast iron) sink [that can only be properly cleaned with bleach] with (blue) dish washing liquid [in the yellow dispenser whose spout has broken] to the left of it, a [half used] paper towel roll above it and a [empty] (stainless steel) dish rack to the right of it, an (compression board) under-counter cabinet [filled with detergents, cleaners and grocery bags] below it}, OPENS THE (stainless steel) FAUCET[that leaked but was recently fixed by the plumber but since has developed a new problem of not releasing water if its lever is too quickly pushed] {attached to the (porcelain covered cast iron) sink [that can only be properly cleaned with bleach] with (blue) dish washing liquid [in the yellow dispenser whose spout has broken] to the left of it, a [half used] paper towel roll above it and a [empty] (stainless steel) dish rack to the right of it, an (compression board) under-counter cabinet [filled with detergents, cleaners and grocery bags] below it} AND FILLS THE (porcelain) CUP [a coffee mug, that her mother gave her and of which only two are left since the others have broken] {in her left hand} WITH (cold) WATER. SHE TAKES THE FILLED (porcelain) CUP [a coffee mug, that her mother gave her and of which only two are left since the others have broken] {in her left hand} TO {passing the stove to her right} THE [jasmine] PLANT [that her mother-in-law gave her, which bears small white eight petal flowers that fall as soon as they bloom] {sitting on the (turquoise Formica) countertop in front of a (double-hung wooden) window, with the (white) refrigerator in front of it, a (stainless steel) spice rack to the right of it, a (plastic covered) wire rack mounted to the wall with (green and fruit) tea and (dark brown) honey to the left of it and a (compression board) shelving unit with (glass, metal and ceramic) bowls and (metal) trays underneath it} AND EMPTIES THE (cold) WATER {placing the (porcelain) cup [a coffee mug, that her mother gave her and of which only two are left since the others have broken] in her left hand above the [jasmine] plant [that her mother-in-law gave her, which bears small white eight petal flowers that fall as soon as they bloom]} INTO THE [jasmine] PLANT'S [that her mother-in-law gave her, which bears small white eight petal flowers that fall as soon as they bloom] (terracotta) POT [which recently replaced a much smaller pot and since the repotting improved the growth and health of the plant]. SHE RETURNS {passing the (black front white top) stove on her left} TO THE (stainless steel) FAUCET [that leaked but was recently fixed by the plumber but since has developed a new problem of not releasing water if its lever is too quickly pushed]

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{attached to the (porcelain covered cast iron) sink **[that can only be properly cleaned with bleach]** with (blue) dishwashing liquid **[in the yellow dispenser whose spout has broken]** to the left of it, a **[half used]** paper towel roll above it and a **[empty]** (stainless steel) dish rack to the right of it, an (compression board) under-counter cabinet **[filled with detergents, cleaners and grocery bags]** below it} AND REFILLS THE (porcelain) [empty] CUP **[a coffee mug, that her mother gave her and of which only two are left since the others** ¹⁹⁴ ²⁰⁶ ²¹⁸ ¹⁹

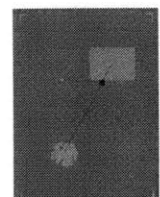
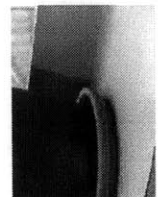
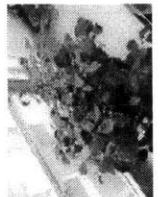
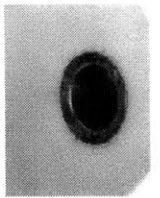
have broken] {in her left hand}.

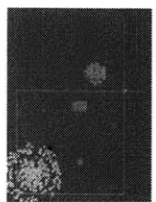
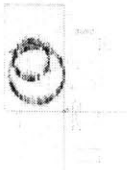
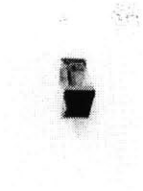
Identity is an attempt at flushing out the history and memory that objects contain. For instance, the faucet that doesn't release water if pushed too quickly or the gifted nature of the cup being used. This additional information suggests relationships that in a large part seem tangential to the event. However, their significance can not be underestimated since they offer us insight into attachments and emotions that give meaning to this otherwise generic event.

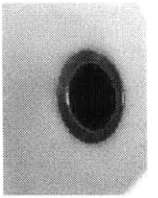
These four categorical filters, process, location, materiality and identity give structure to the description. The categories are a means of probing into the event. They can be anything but to be effective they should be guided by questions that one would pose to the participants in the event (animate or inanimate) to learn more about them and their relationship to their surroundings.

What is the difference between a thin and thick description of a 19sec event? The type of information they provide and the way it is communicated influences the space they construct. The thickened description with its many asides extends the time of the telling. Although the internal clocks of the two are the same we are entertained in the thick description with many details that enrich our understanding of the space. This extended telling is like a slow motion through the event. Although both descriptions follow the same trajectory, the difference in the two spaces results from a modulation (faster or slower) of time.

Following the strategy for modulating threading time, the description space can be altered to create new readings through the event space.



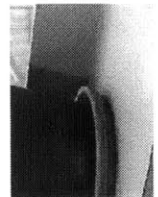
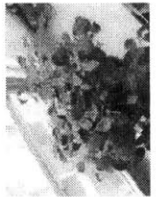




This is a license for creative editing which can reveal new relationships. Two re-readings follow:

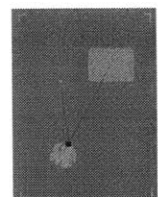
[Laura, who has painstakingly cared for her houseplants] [that can be only properly cleaned with bleach] [newly replaced] [containing square dishes, bowls, glasses and mugs] [a coffee mug, that her mother gave her and of which only two are left since the others have broken] [that leaked but was recently fixed by the plumber but since has developed a new problem of not releasing water if its lever is too quickly pushed] [that can only be properly cleaned with bleach] [empty] [filled with detergents, cleaners and grocery bags][that leaked but was recently fixed by the plumber but since has developed a new problem of not releasing water if its lever is too quickly pushed] [that can only be properly cleaned with bleach] [in the yellow dispenser whose spout has broken] [half used] [empty] [filled with detergents, cleaners and grocery bags] [a coffee mug, that her mother gave her and of which only two are left since the others have broken] [a coffee mug, that her mother gave her and of which only two are left since the others have broken] [jasmine] [that her mother-in-law gave her, which bears small white eight petal flowers that fall as soon as they bloom] [a coffee mug, that her mother gave her and of which only two are left since the others have broken] [jasmine] [that her mother-in-law gave her, which bears small white eight petal flowers that fall as soon as they bloom] [jasmine] [that her mother-in-law gave her, which bears small white eight petal flowers that fall as soon as they bloom] [which recently replaced a much smaller pot and since the repotting improved the growth and health of the plant]. [that leaked but was recently fixed by the plumber but since has developed a new problem of not releasing water if its lever is too quickly pushed] [that can only be properly cleaned with bleach] [in the yellow dispenser whose spout has broken] [half used] [empty] [filled with detergents, cleaners and grocery bags] [empty] [a coffee mug, that her mother gave her and of which only two are left since the others have broken] .

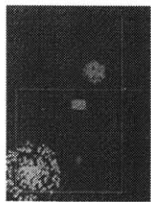
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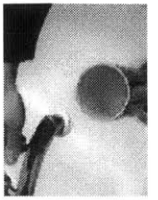


A WOMAN (dressed in a hip length sweater and corduroy pant and black leather bottom shoes){standing in front of a **[newly replaced]** dishwasher **[containing square dishes, bowls, glasses and mugs]** PLACES A CUP **[a coffee mug, that her mother gave her and of which only two are left since the others have broken]** **[that can only be properly cleaned with bleach]** **[in the yellow dispenser whose spout has broken]**, FILLS THE **[jasmine]** PLANT **[that her mother-in-law gave her, which bears small white eight petal flowers that fall as soon as they bloom]** , with (cold) WATER **[that her mother-in-law gave her]** SHE RETURNS with (blue) dishwashing liquid paper towel roll **detergents, cleaners and grocery bags** AND THE (porcelain) [empty] CUP in her left hand.

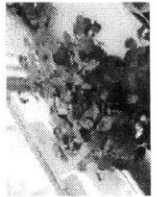
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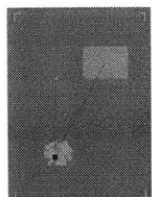
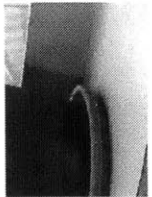


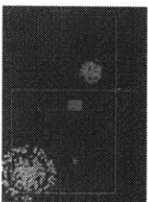
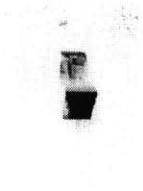


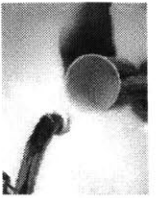
The first one follows only the identity descriptions. The description space is much more static and the telling stems around understanding a cup that “leaked but was recently fixed up by the plumber ...”, “can only be cleaned with bleach ...” “filled with detergent ...” and its relation to “jasmine” that “bears small white eight petal flowers that fall as soon as they bloom,” which might have to do with making jasmine tea.



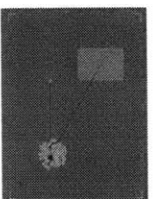
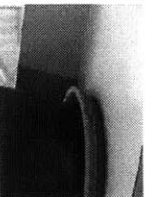
The second reading follows a random path in which a dishwasher contains “square dishes, bowls, glasses...” and a cup “can only be cleaned with bleach” and “the jasmine plant” is filled with cold water. The description space is one of housecleaning or even shopping. Where is she returning from “with (blue) dish washing liquid...” etc. Through the act of editing and re-reading the description space is transformed into other spaces. Some of these spaces are “static” where the relationship between objects is based on location (“containing square dishes, bowls, ...” “filled with detergent...”) or associations (“that her mother gave her...” or “that leaked...”), while others are “mobile” based on movement (“places a cup...” or “she returns with...”). This is an important distinction because it questions the argument that “movement” is the basis for temporal space-making. Although movement is essential in a particular kind of making, it is the element of time that is necessary for both “static” and “mobile” space. In description space time is in the telling or reading which is in the reader’s control and makes reading one of the most interactive activities.



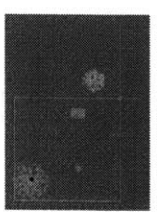
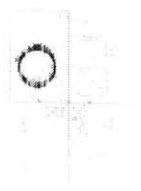
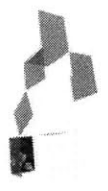




III. CAMERA SPACE



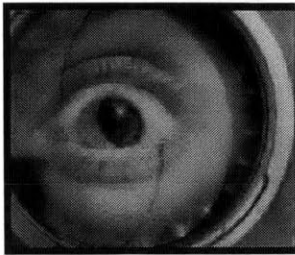
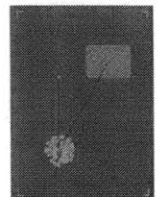
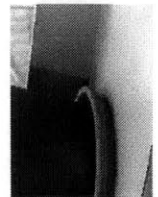
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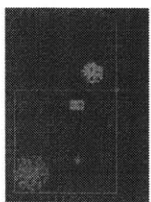
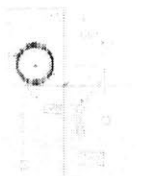
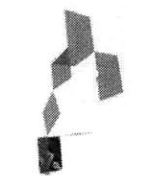
The Camera as Medium:

Dziga Vertov's, "Man with a Movie Camera", of 1929 ends with the haunting image of a human eye superimposed on a camera lens with its shutter slowly closing. Vertov's movie is a fantastic exploitation of the medium of film. His final image is a succinct summary of what the audience has experienced throughout the film, that is, what the world looks like if the eye became a movie camera. The film's subject matter is everyday life: work, leisure, sports, transportation etc., but since the eye has become the camera, reality is not the same. Distinct events can be superimposed, exposed on the same frame of the celluloid or montaged together on different frames, speeded up, slowed down, stopped in mid-motion, reversed and animated. The movie's amalgamation of filmic effects received sharp criticism for "formalistic jackstraws and unmotivated camera mischief," (Eisenstein, *Film Form*, p. 43) and "his arabesque totally covered the ground plan, his fugue destroyed every melody." (O'Brien, *Kino-Eye*, p. xx) But Vertov's work, seen now 72 years after its first showing, sends an altogether different message. Concentrating on the medium of production and not on a message the film is less propagandistic than other contemporary soviet works.



Vertov's Kino Eye from "Man with a Movie Camera", 1929

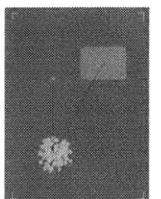
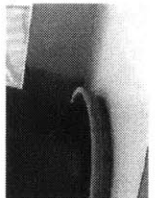
Vertov's underlying theme is the expression of the "kino eye" or cinematic eye. He writes: "From the viewpoint of the ordinary eye you see untruth. From the viewpoint of the cinematic eye (aided by special cinematic means, in this case, accelerated shooting) you see the truth. If it is a question of reading someone's thoughts at a distance (and often what matters to us is not to hear a person's words but to read his thoughts), then you have the opportunity right here. It has been revealed by the kino eye." ("Three Songs of Lenin and Kino-Eye", *Kino-Eye*, p. 123.) Footage of a cam-

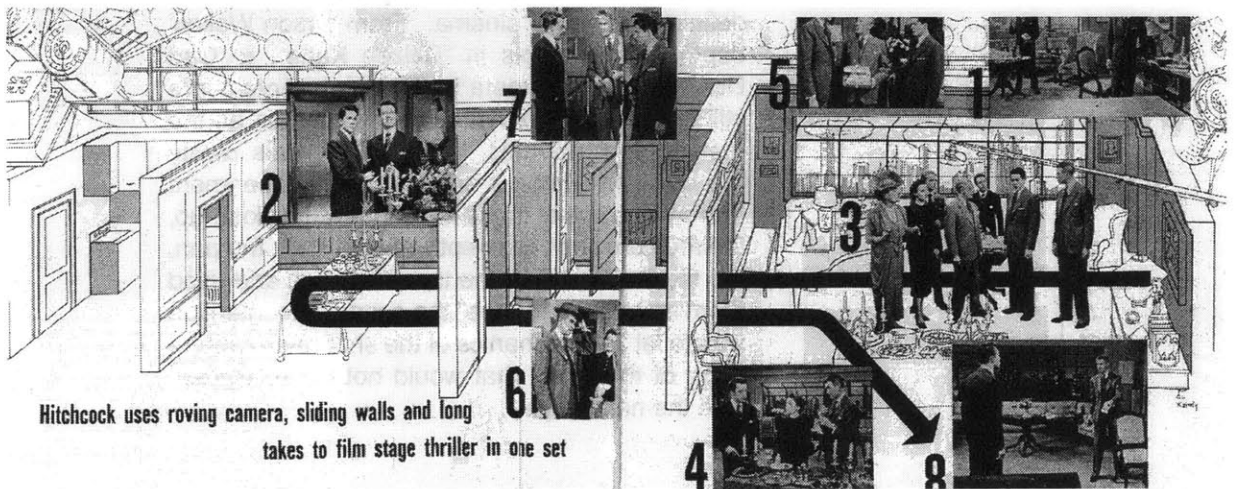


eraman filming dangerously balanced on a girder, crouching in a dark mine, or riding a motorcycle remind the audience of the bodily origin of what they see. The camera is a prosthetic extension to the body that enhances the cameraman's ability to see, as well as to record and share his "sight" with others.

The cameraman's techniques in cinema have developed a repertoire of "shots", the way in which a camera is positioned, aimed, moved or not in relation to what it is seeing and recording, which assist in telling the story. Some of these shots include, the close-up, the medium shot, the long shot, the pan, the moving shot and the traveling shot. Their combination determines the scene: "the traditional Hollywood school of thought in an introductory sequence, for example, stated that you begin with a long shot, follow with a medium shot, then two over-the-shoulder shots and two single close-ups. That constituted what they called a complete coverage of a scene." (Young, *The Work of the Motion Picture Cameraman*, p. 160)

The misuse, continuous use and recombination of these techniques have, arguably, resulted in defining the art of cinema. From Orson Welles' depth of field shots in "Citizen Kane", to Carl Dreyer's roving camera in "Ordet", to Antonioni's still framings in "L'Aventura", the camera as the "seeing eye" narrates, hides and reveals reality like our own eyes but different. This experiment borrowed some of these techniques: the close-up, the medium shot, the depth-of-field shot, the pan, the moving shot and the traveling shot, and used them as tools to "re-see" the event. The intention was to let the mechanics of the shot reveal something of the event that would not be so evident with the naked eye.





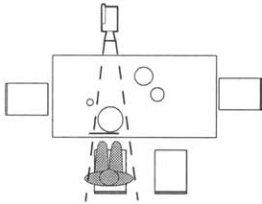
Hitchcock, shot sequence for "Rope", Look Magazine, 1948



Camera Techniques:

The Close-up:

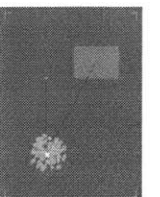
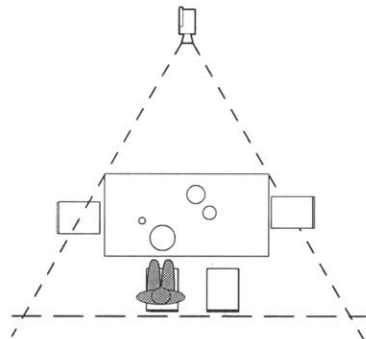
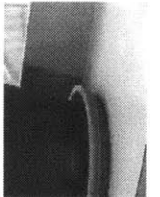
In the close-up shot the camera is brought close to an object or character in order to rarefy it. The frame of the camera cuts out of the shot all items except that item or items which are under scrutiny. Close-ups are commonly used in filming conversation so as to isolate the talking head from its surroundings. Variations in the close-up can result from changing the point of view (POV), and viewing from slightly below, above, left or right of the object. There are wonderful close-ups in Vertov's "Man with a Movie Camera", of hands performing different tasks, from folding boxes to washing hair.



Vertov, "Man with a Movie Camera", 1929

The Medium Shot:

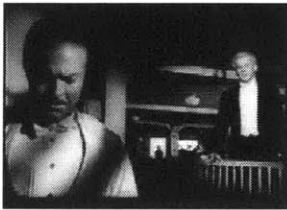
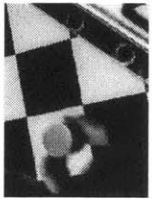
The medium shot captures the entire space of the scene within its frame. Its important metrics include the angle of view and the distance from the objects and characters in the scene, so that the audience feels that it is a participant in the scene. Alfred Hitchcock's "Rope" takes advantage of the participatory character of this shot by constantly re-establishing this camera space around the different conversations taking place in the party. The entire movie takes place in an apartment, whose spatial configuration the viewer comes to know quite early in the film. Hitchcock is able to impart the uneasiness of his characters to the audience by continually re-establishing the medium shot. The shot makes the audience a party to the murderer's private conversations with the full knowledge that some other character might move into the shot and discover the plot that is being hatched. This adds to the suspense



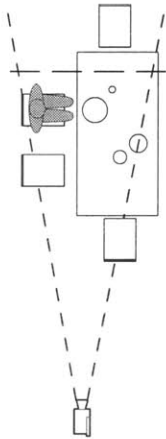


Carl Dreyer, "Vampyr", 1931

that the scene imparts.



Orson Welles, "Citizen Kane", 1941



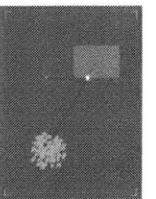
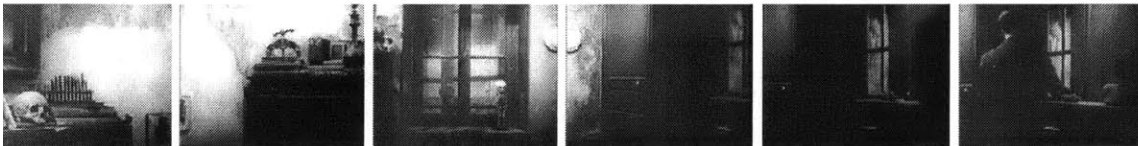
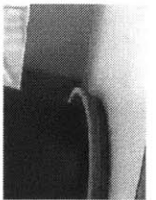
The Depth of Field Shot:

The depth of field shot places the camera parallel to the action in the scene. The idea is to create a greater depth perception in the scene, like a forced perspective. Because films are projected on a screen, the eye is always focused at the distance of the screen. The depth of field shot attempts to increase the depth perception by constructing it within the camera space. Orson Welles in "Citizen Kane" privileges the depth-of-field shot over medium or long shots. This makes even the most banal activities, a conversation or walking, into a visually dramatic event. Welles further enhances his depth of field shots by playing with light densities within the frame. A good example is the shot of Kane typing away in the foreground as his partner makes his way from his well lit office, through the darkness of the newsroom, towards Kane.



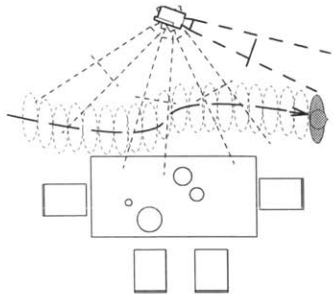
The Pan Shot:

The pan places the camera in either one of the previously mentioned shot positions or at a desired distance from the scene, and pivots it about its own center. This shot is commonly used to follow an object as it moves through the scene. The pan describes a passage, either of the eye or a person through a scene. Carl Dreyer in "Vampyr" plays on this dual aspect of the pan when he begins his shot on David Gray, the pro-





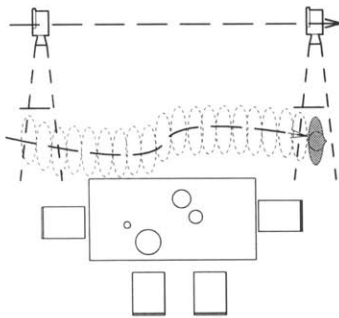
Carl Dreyer, "Gertrud", 1969



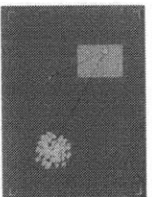
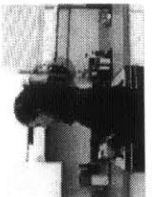
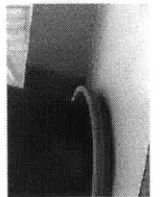
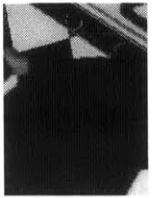
tagonist, opening the door to enter a room, and pans away from Gray (where is Gray? still at the door?) to film the entire room and stops the pan at another door, as Gray suddenly appears from the right side of the frame (since he had been moving with the camera) to exit the room from this door. Dreyer follows this with another similar shot through another room creating a complex movement through space, of pans and counter-pans, that disorient the viewer and bring incredible complexity to an otherwise straight forward movement.

The Moving Shot or Tracking Shot:

The moving shot has the camera physically moving along a trajectory usually following an object through the space of the scene.

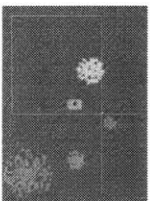


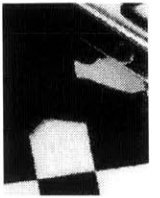
Cinematically it is useful for suggesting a continuity of spatial relations that might not be so evident in multiple cuts. In Carl Dreyer's "Gertrud" a wonderful moving shot begins with Gertrud arriving at her lover's apartment and knocking on the door to be invited in. Her movement from passing through the door, stopping momentarily, walking to the window to place the flowers in her hand into a vase, is caught by the camera in an uncut moving shot. The camera moves along a straight line, passing miraculously through the wall as she crosses the door, stopping when she stops and centering her in the frame as she goes to place the flowers.





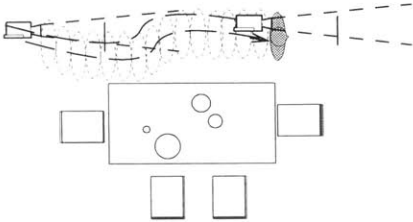
Andrey Tarkovsky, "Stalker", 1979





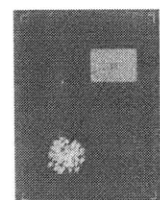
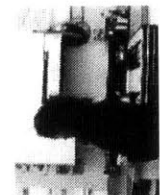
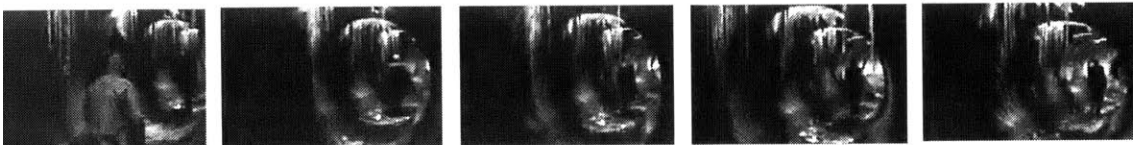
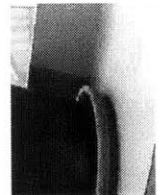
The Traveling shot:

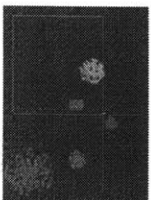
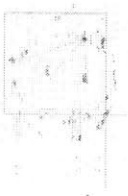
The traveling shot is the camera as the eye in motion. It tries to mimic the movements of the eye and head, changing the point of attention in the subjective manner of human sight.



This can be seen in much of "cinema verite" traveling shots where the reporter and cameraman are running after the politician while reporting from location. In fiction films, examples can be seen in the horror genre where it creates suspense for the audience by taking the point of view of the killer or the victim.

Tarkovsky uses a traveling shot in his film "Stalker" in the scene where the three protagonists are moving through a tunnel to get to the mystical room. The shot is affective in immersing the audience into the character's experience.





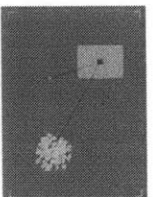
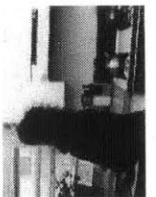
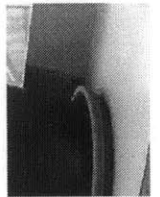
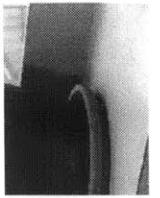
The Camera Space of the event:

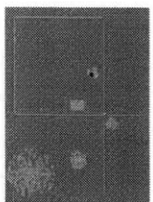
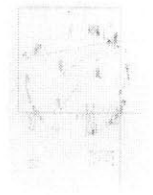
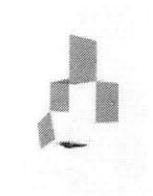
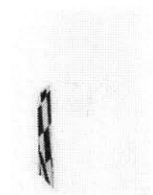
A digital video camera was used for the following experiments. Although it had rendering effects like sepia-tone, black and white, old film etc., these effects were strictly avoided because the interest was not in the fabrication of the digital image but in the camera space. The camera's function of aperture, zoom and portability were the only features exploited. The shooting was carried out in two sessions. The first filmed the event using the following shots: the close-up, the depth of field, the medium, the pan and the traveling. These shots were carefully scrutinized and their analysis initiated another session of shootings. Both sessions cumulatively produced 20 different shots, which have been divided into two types: the action image and the relation image. The hypothesis for the experiment was that each shot, being a particular recording of the event would reveal something unique about it. This followed the thinking that a medium, in this case a camera, fabricates as much as it records. The peculiarities of this fabrication might reveal something that would otherwise go unnoticed.

The Action image:

The panning shot of the event or the depth of field shot are examples of an action image. In it the camera follows the action, or in the case that it doesn't move, it frames the entire action. This results in the action setting the internal as well as the perceived time. The observer, as the camera, synchronizes its motion with that of the action. The form of the space is a result of the synchronized mobility of the viewer and the action.

The action image has been of some interest to scientists and artists. At the heart of these investigation has been the fascination with move-

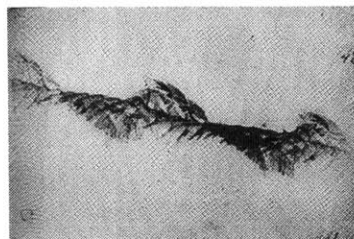




Pan Shot of the event



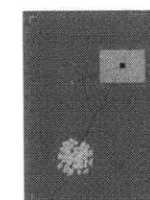
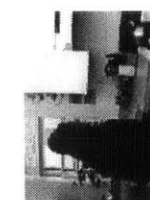
Muybridge, *Mohomet Running*, 1879

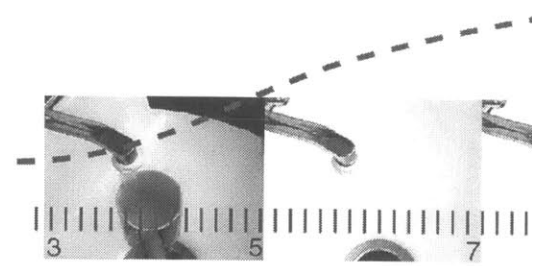


Marey, *The Flight of the Seagull*, 1886

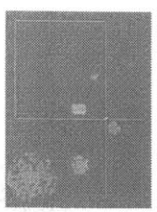
ment. The works of Muybridge, Marey or Edgerton are all examples of seeing the hidden reality in motion. Muybridge's famous "The Horse in Motion" proved the hypothesis of unsupported transit, that is, that a trotting horse has moments in his stride when all four feet leave the ground. Muybridge and Edgerton's scientific studies of locomotion celebrate the unseen instance. The instance captures the essence of the entire locomotion: Muybridge's levitating horse, or Edgerton's milk drop. However, in Marey the interest lies in the intervals, that is, the gaps that show that movement is made up of still other movements. This same interest in the interval can be seen in Duchamp's, "Nude Descending Stairs" or Picasso's cubist "Girl with Mandolin".

The action image of the pan, or for that matter the traveling or depth of field shot, is neither interested in the instance nor the intervals of the action but in the immersive experience of it. The corporeal presence in the pan is analogous to the movement of the head or the shifting of the eyes from one side to another. Bodily immersion is achieved through the camera's ability to establish a believable point of view and then to mimic the act of viewing with all its subjective bodily movements. The depth of field shot relies on spatial projection as opposed to movement for its immersive effect. Looking from the plant to the faucet the spatial relationship of the objects, including the viewer, to each other is layered within the frame. The traveling shot, of course, takes immersion to its ultimate conclusion, by allowing the viewer to actually embody one of the objects in the event.





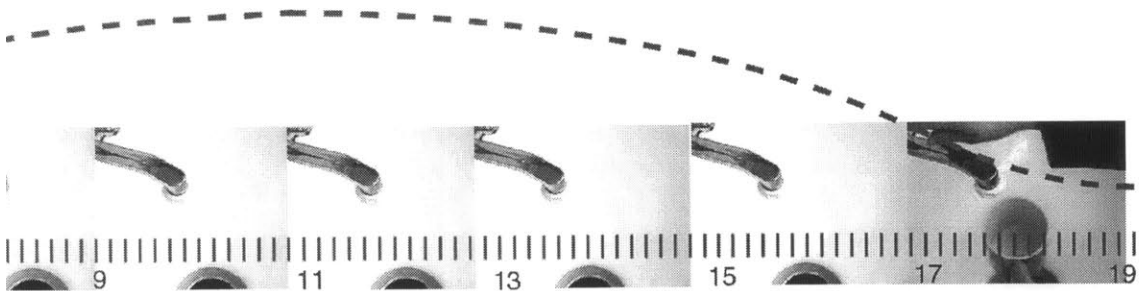
Relation Shot of cup and faucet

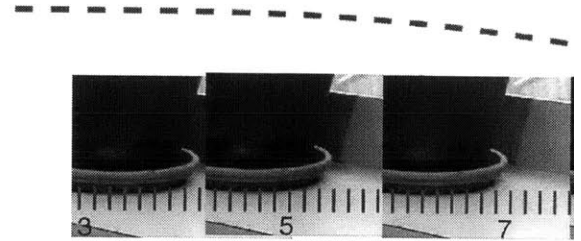


The Relation Image

In contrast to the pan, travel and depth of field shots, the close-up produces a very different image. In it the camera's frame acts as a cutting device allowing the action to leave and then re-engage the shot as the event unfolds. By separating the event's action from the shot, the camera is free to explore or concentrate on tangential actions. These are telling images of the event's space, which can shed light on such things as motivations and emotions. A close-up of the sink captures the beginning of the action, opening the faucet and filling the cup, but remains with the faucet although the action has moved to the plant, and only re-engages the action when "Laura" returns to fill the cup. What became apparent was that this image revelled in the moment. It was, like the categorical filters in description space that became the basis for tangential thoughts. After the action has left the frame, the faucet continues to drip a few drops. The relationship between water and the faucet, that it fills the cup, and that it also drips, takes on extended meaning in the event.

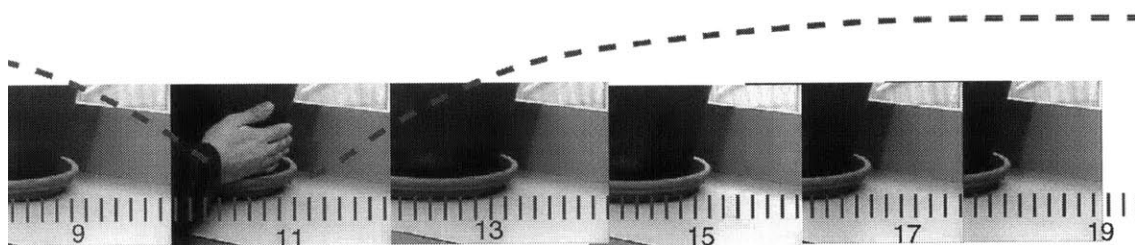
The relation image became the basis for a series of shots that tried to capture in the motion of the event, moments of relational transcendence. Each of these shots was the length of the event, 19 seconds, and maintained the event's temporal beginning and end. The relationships that were explored were, faucet and hand, faucet and water,





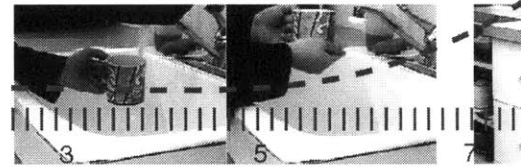
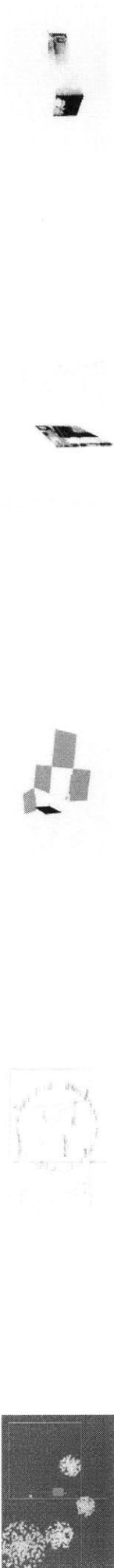
Relation Shot of hand and plant

faucet and cup, cup and water, cup and hand, cup and plant, plant and hand, plant and water, water and drain. Although most of these relationships can be envisioned in the mind's eye, the need to make them apparent in camera space required rethinking the repertoire of shots. The close-up was the basis for most of these shots, but it became clear that the point of view, that is the camera's relation to the objects, was to be determined by the objects and not the action. I will concentrate on two relation shots, one which used the still frame of the close-up and another that used a pan to discuss two relationships that could not have come to light without this method.

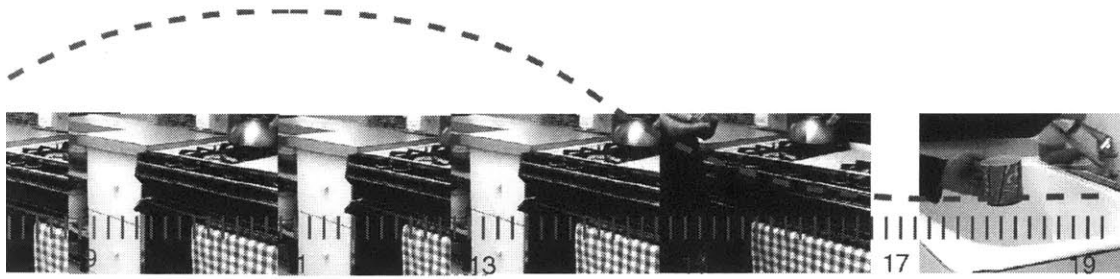


The relationship between hand and plant is understood as having something to do with the process of watering. This obviously is a result of concentrating on the action and not the relationship. The relation image of the hand and plant captures the moment when the right hand (the cup is in the left hand) holds the plant's pot while watering. It is a moment that is easily missed if the camera, and consequently the viewer, is following the action. When it is viewed for the entire 19 seconds it becomes clear that it has the power to speak for the entire event. Laura's intimate relation with the plant, that is an underlying cause for the event, is succinctly presented in this image.

The second relation image is a pan that explores the relation between the hand and water. Here



Relation Shot of hand and cup

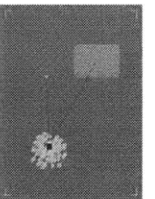
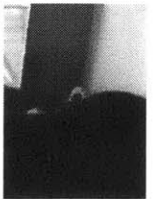
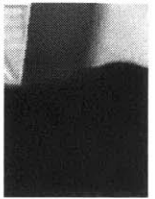


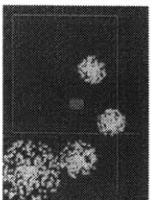
again the relationship seems to be tied to the action; that is with the water inside the cup. However, the shot reveals that the right hand, once the cup is filled with water, slips underneath the cup to catch the water that might drip off it and onto the floor. This image reveals a new role for water, which in the action shot was of nourishment for the plant to be one of dirtiness and potential danger. In other words, water droplets on the floor will create stains or even worse a hazardous slipping condition.

These two types of images set up the vocabulary for analyzing the architecture of the temporal event through camera space. First there is the frame that defines the field of observation, which is not to be confused with the space of the event. Then there is the action, which is the animate relationship between the event's objects and finally there is the temporal duration of the event. It is the combination of these three operations that create the space of the event.

Montage

Time in the cinematic image is created through the framing of the shots and montage. Montage is the joining of disparate shots to create a single scene. For Eisenstein, montage resulted from the collision of shots. This collision could produce

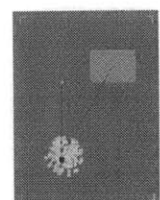
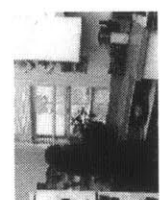


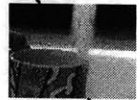
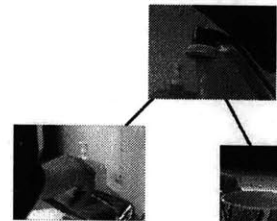
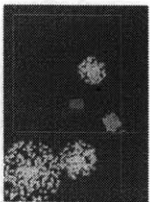
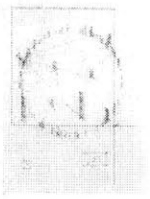
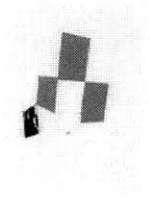
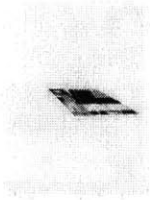
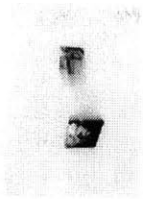


“conflict” or “continuity” in the scene depending on the types of shots used. He writes, “The shot is by no means an element of montage. The shot is a montage cell. Just as a cell in their division form a phenomenon of another order, the organism or embryo, so, on the other side of the dialectical leap from the shot, there is montage.” (Eisenstein, *Film Form*, p. 37). The success of a montage is measured by its ability to appear as a whole, regardless of the fact that it is made up of many shots.

The experiments that were done in montage fell outside the confines of camera techniques and were carried out in Adobe Premiere 5.0. In-camera editing, where the cutting and piecing together of images happens while filming, was ruled out because of the brevity of the event. It wasn't technically feasible to experiment with montaging the scene while shooting an event that lasted only 19 seconds. At the same time, Adobe Premiere 5.0 was used for importing the raw shots, re-sizing and splicing them, and exporting them as Quick-Time movies. All other features of digital manipulation (special effects, transitions) were strictly avoided because they were not deemed critical to camera space.

Montage effects the event's actions, time and space by the rhythm it creates in the frequency of its cuts. The cuts are between one shot and another of the montage. Deleuze in his description of “movement-images” describes the nature of the shot: “the movement-image has two sides, one in relation to objects whose relative position it varies, the other in relation to a whole- of which it expresses an absolute change. The positions are in space, but the whole that changes is in time. If the movement-image is assimilated to the shot, we call framing the first facet of the shot turned towards objects, and montage the other facet turned towards the whole. Hence





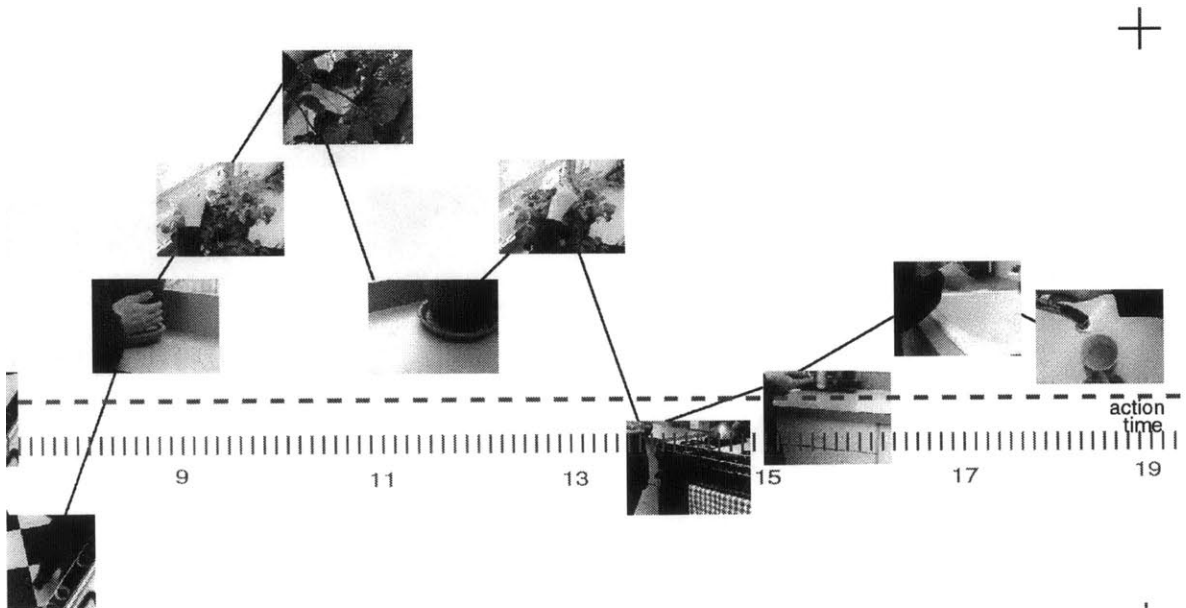
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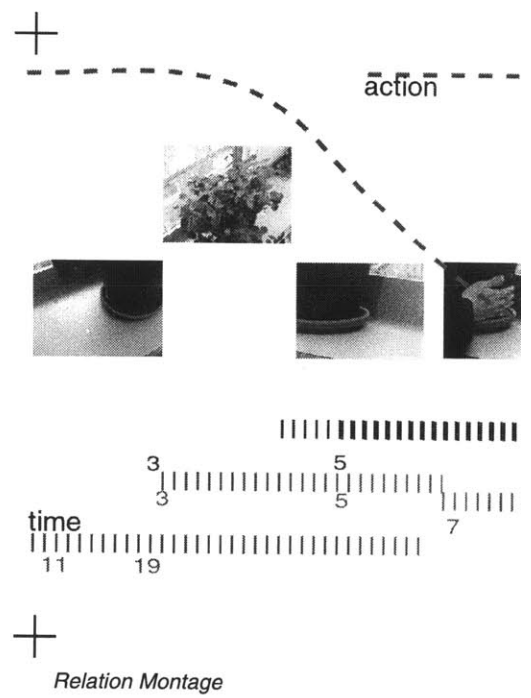
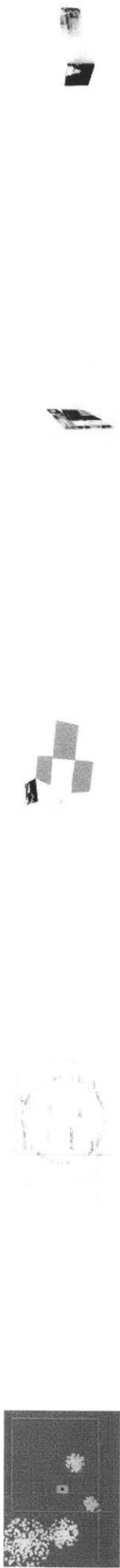


Action Montage

a first thesis: it is montage itself which constitutes the whole, and thus gives us the image of time.”(Deleuze, *Cinema II*, p.34). The role of frame and montage in the representation of space and time became the basis for the experiments that follow.

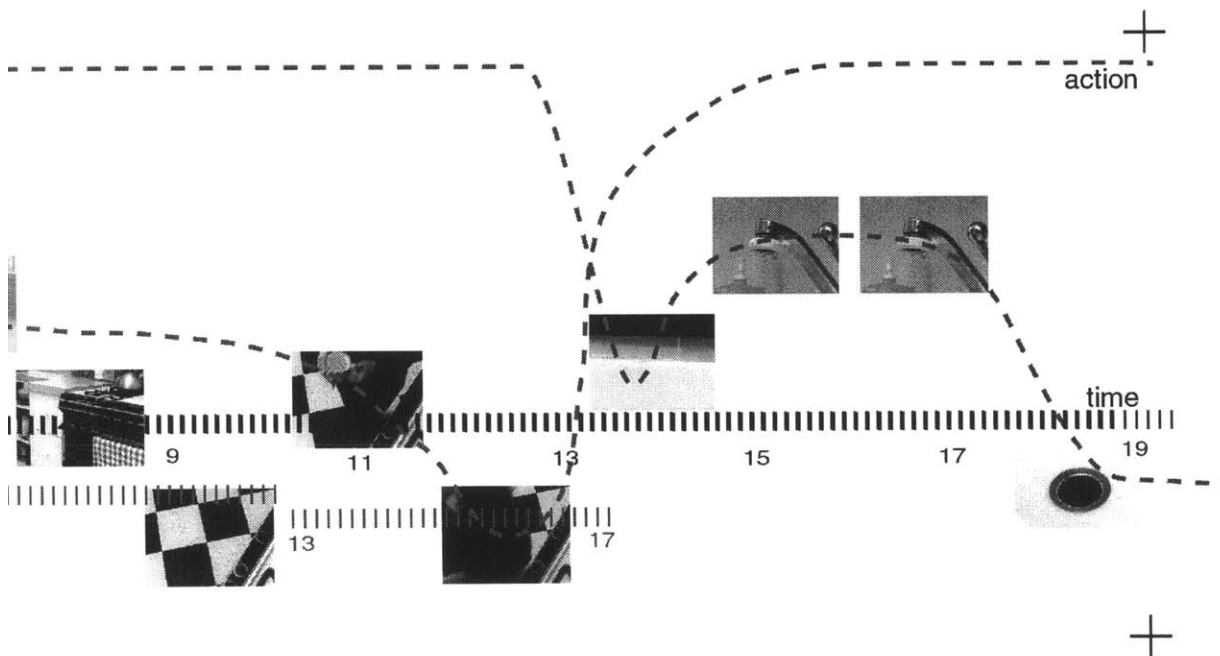
Using the temporal boundary of 19 seconds, two montaged scenes were created each pursuing a different path through the event space. The first montage (“action montage”) synchronized the cutting with the action. This produced a linking of action images, but this time with different points of view (POV’s). All the shots are close-ups that take up different positions in space to observe the event. Because there is a cause and effect relationship created by the montaging of these shots, that is, there is a continuity of a single action, through all the shots we can accept the varying points of view. The perceived time, which is the viewer’s sense of time in watching the montage, is synchronized with the action.

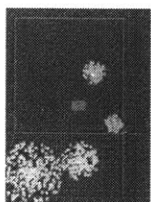




The second montage ("relation montage") follows a different trajectory. It is composed of 11 shots that begin at one end of the space and proceed to the other end. The action engages the montage at two points, otherwise the montage follows its own agenda. Although both montages are 19 seconds long, the second one is perceived to be longer. This is because the rhythm of the first is synchronized with a single action, while in the second the rhythm is set up by perceived lack of action.

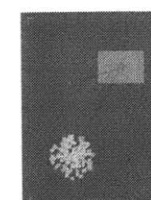
What this suggests is that the space of the event needn't be tied exclusively to a single action. Because this space is constructed from the event, its metrics can not be reduced to euclidean coordinates. The test is in whether, after its construction the space resonates of the event.

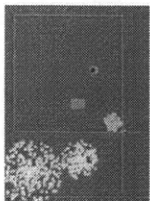
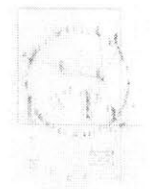
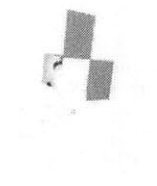
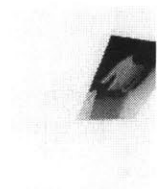


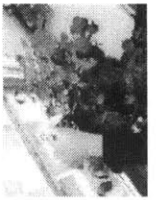




IV. GAME SPACE







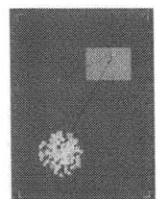
Game space is the space of simulation. It is the space of relations and communications that results from simple behaviors. The behaviors can be contained in the components or can be instigated by the environment. A good way to explain this is by comparing two games: chess and monopoly. In chess the pieces contain all the rules of the game's behavior. The king's movements are not determined by the board but by the piece. Each piece contains within it all the characteristics of its movements and status. The game board simply provides a boundary upon which play can occur. The game of monopoly is just the opposite. The pieces in themselves contain no rules. They stand as representations of the players so that picking one over the other does not affect play, but is only a matter of personal preference. The game board, on the other hand, is critical to the play because it dictates to the players what they need to do ("go to jail", "pay fine"). All behaviors for the game emanate from the instructions the board provides.

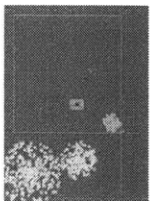


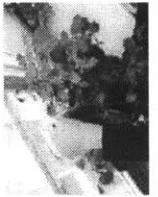
Gaming space is useful for making behaviors explicit. Simple behaviors can have cumulative effects that are not evident from the behaviors themselves. Mitchell Resnick has termed these conditions as "massively parallel micro-worlds," where many actors with simple behaviors are able to interact with each other and their environment.



He argues that the simple behaviors of individual actors can cause organizations to emerge without the direction of a single coordinator. Take the example of a colony of termites that can miraculously coordinate their work to create a single pile of wood chips. One explanation would suggest that all the termites are conscious of this objective and are engaged in a collaborative effort to complete the task. This would also mean that they have a sophisticated form of communica-







tion which allows them to monitor their activities. Resnick shows, using the StarLogo simulation environment, that the single piling can also result if each termite follows a set of simple rules:

- if you come upon a wood chip pick it up
- if you bump into another wood chip put the wood chip you are carrying down next to it



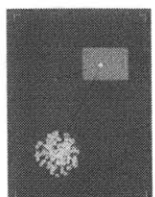
This suggests that each termite is acting on its own impulses and not under some central directive. The single pile of wood chips is an emergent property of multiple agents independently acting on simple rules.

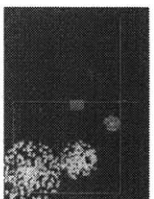
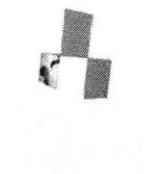
Computation as medium:

The word compute means to calculate. In the case of a computer, data is fed into it which then is computed upon to supply a result. The means for communicating with the computer is through computer programming. This is done through a programming language (Java in the case of this thesis) which constructs the algorithms that are the set of rules that determine the parameters of the solution. An important distinction needs to be made between algorithms and heuristics. The algorithm is the solution while the heuristics are the means or methods of arriving at that solution. By defining the correct heuristics the programmer is able to construct an algorithm(s) to control the data and manipulate it to the desired result.



To understand computation as a medium a distinction needs to be made between “digital” and “analog” media. Timothy Binkley draws the difference by suggesting that “analog” media (paint, pencil, chisel) “transcribe” information from one physical material to another, whereas “digital” media “convert” information from a physical mate-

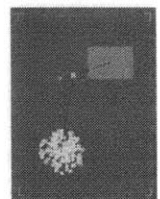
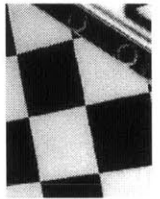
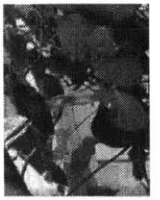


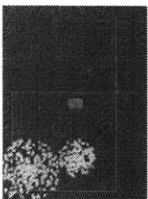


rial to a numerical entity. For example a chisel transcribes the human figure into a stone sculpture, whereas a computer converts the data on the human figure (height, location, color, etc.) into a numerical file that is then converted back to the image on the monitor or printer. This example shows how digital media is freed from the constraints of materiality that exist in analog media because "the two functions of storing and displaying information are relatively independent." (Binkley, "The Vitality of Digital Creation", p.110) This separation between storage and display allows users to manipulate the numerical file through computation.

According to Binkley the two main concepts that characterize the change from analog to digital media are "virtuality" and "interaction". Virtuality results from the conversion of physical objects into numbers. These objects exist in the computer in two different spaces: "image space" and "object space". Image space is located in the computer's frame buffer as an array of numbers that represent individual pixels with red, green or blue values. The object space is located throughout the computer's memory and it defines virtual objects by their virtual properties. It is in the object space that computational realities can be created with their own algorithmically controlled behaviors. The ability to manipulate these algorithms as well as create new ones is the basis for user interaction. This is a dynamic phenomenon that lets the user change the resulting artwork in real time. As such it is fair to characterize the computer as an "active" media in contrast to pencil, paint, and chisel as "passive" media.

Using the computer as a medium in the creative act has a short history. Only recently have computers achieved the processing capabilities to allow for computationally intense work. This has resulted in a flood of applications including

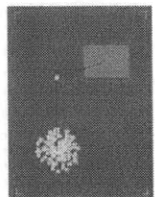
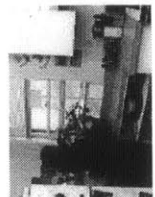
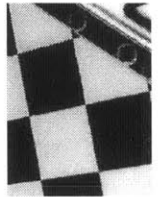


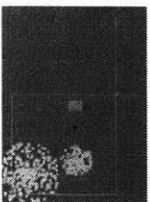


CAD (AutoCAD, VectorWorks), 3-D modeling (3-D studio, Maya), and Image Processing (PhotoShop) software that allow users to take advantage of computation without ever having to understand its workings. This has great advantages but eventually will create homogeneous results where most drawings produced in a particular program will be indistinguishable from one another. This points to the fact that a program can not be compared as a medium to say paint because constraints possibilities. This is fine when a clearly defined task need to be performed but is less than ideal for artistic creation.

What is required of an artistic medium is range: the ability to allow for endless variations in its expression. For the computer, computation is the medium, and computer programming is the means to use it. However, presently most programs are modified versions of older more traditional media. It will be a while before the computer can truly become a collaborator in the creative act as outlined in six stages by Robert Mallery:

"In the first stage the machine presents proposals and variants for the artists consideration without any qualitative judgements, yet the man machine symbiosis is synergetic. At the second stage the computer becomes an indispensable component in the production of an art that would be impossible with out it, such as constructing holographic interface patterns. In the third stage, the machine makes autonomous decisions on alternative possibilities that ultimately govern the outcome of the artwork, these decisions however, are made within parameters defined in the program. At the fourth stage the computer makes decisions not anticipated by the artist because they have not been defined in the program. This ability does not yet exist for machines. At the fifth stage... the artist "is no longer needed" and "like a child, can







only get in the way." He would still however be able to "pull out the plug," a capability he will not possess when and if the computer ever reaches the sixth stage of "pure disembodied energy." (Youngblood, *Expanded Cinema*, p. 191)

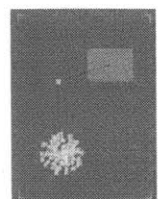
Simulation and Occurrence diagrams:

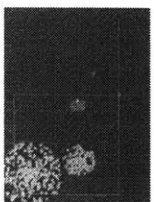
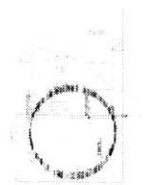
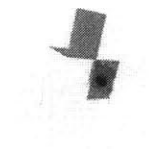
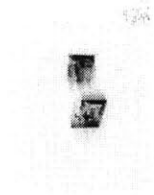


A simulation is a "dynamic execution or manipulation of a model of an object's system for some purpose" (Barton, *A Primer on Simulation and Gaming*, p.6). Some terms that need to be clarified here include "object system", which means the system one is studying and "model" which is a representation of that system. The word simulation, as opposed to representation, model, or micro world is most appropriate for what was produced computationally for the thesis because, firstly it can only be understood in relation to the event it represents and secondly, it is dynamic. To construct a simulation one has to be clear about what one wants to study and then be able to construct the heuristics necessary to code the algorithms.



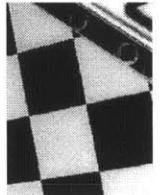
In the fall of 1990 I had the privilege of studying for a brief time with cyberneticist Gordon Pask at the Architectural Association. My interest in alternative forms of description led him to present me with some pages from Mary Catherine Bateson's book, "Our Own Metaphor. A Personal Account of a Conference on the Effects of Conscious Purpose on Human Adaptation." These pages explained forms of notation called "occurrence diagrams" that were representations of "process". The claim was that it was a "holistic method of description, ways of understanding complex processes that did not depend on breaking them into parts to be studied in isolation from each other." (p. 165).





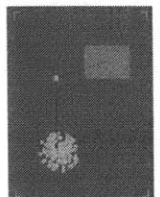
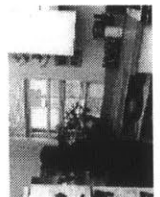
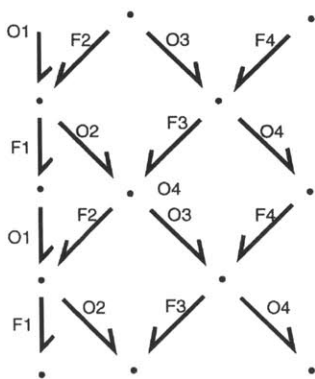


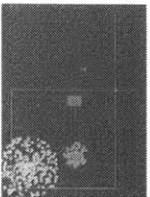
The notation is made up of points: an occurrence point and an arrow. The occurrence point designates a change in state while the arrow represents a maintaining of state. This may seem counter-intuitive because arrows inherently symbolize movement. However a simple example of a pendulum swinging left (L) and right (R) clarifies its use:

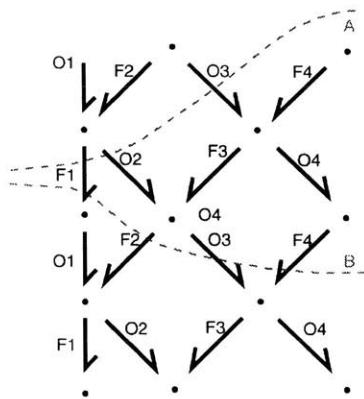


The pendulum swings right as indicated by (1) then changes state to a left swing indicated by (2). This change of state occurs at the point between (1) and (2).

To better illustrate the quality of this notation, a more complex example of traffic moving in a one way street is presented. The traffic is all moving in one direction. To understand the action pattern of this event the street has been divided into cells (1,2,3,4) which are long enough to contain one car. As a car moves out of a cell, that cell is free, but the cell that the car has moved into is occupied. The event diagram would indicate whether a cell (1,2,3,4,) is occupied (O) or free (F) so that the occurrence point where cell1 goes from being occupied to being free is the same point as when cell2 goes from being free to being occupied. The occurrence diagram orders the event into a series of before and after relationships. So that we can follow one strand of pre net (O1, O2, O3, O4) which would indicate that all the cells are occupied and suggests that there is traffic. Or another (O3, O4, F4, F3) which suggests that cell3 can only be free if cell4 is free. And finally,





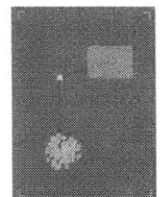
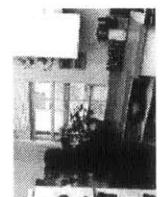
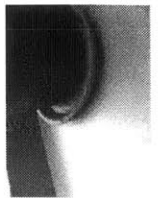


(F4, F3, F2, F1) indicates that all cells are free, opposite in sequence from the way that they are occupied, to suggest that there is no traffic. It is important to note here that the length of the arrows means nothing. Also, the fact that the occurrence points line up horizontally does not indicate simultaneity in time of the two occurrences. "Simultaneity", that is, that two events occur at the same time, where time is measured by some universal clock to which both events are causally connected is indicated in the diagrams by a dashed line called a "time-slice". So that time-slice "A" shows a simultaneity between (F1, O2, O3, O4) while time-slice "B" shows (F1, F2, O3, F4) to be simultaneous. This indicates a freedom in the diagram to entertain multiple possibilities in the action of the event.

This brings up the final concept in relation to this diagram, that of "concurrency". Concurrency is when two events are "independent of each other with no necessary time ordering." (p. 188) Looking at the example of the time slices we can say that events in cell1 and cell4 are concurrent to one another. So that in time slices "A" cell1 is free(F1) and cell4 is occupied, while in time slice "B" cell1 is free(F1) and cell4 is also free(F4). Concurrency is useful because it breaks up the problem of linear causality. It opens a door in the system where things can go "wrong" and give unexpected results.

Simulation 1

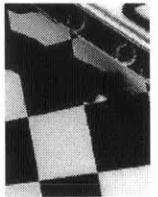
The first simulation looked at the relationship between four objects: plant, water, sink, and cup. Reflecting on the actual event, the simulation would enact the process of watering the plant, which in turn would cause the plant to grow. This required that each object have control over what it did, and how it did it as well as the ability to maintain its state.





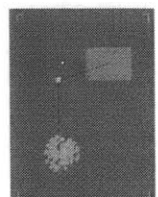
Each object was implemented as an instance of a class that maintained the following parameters:

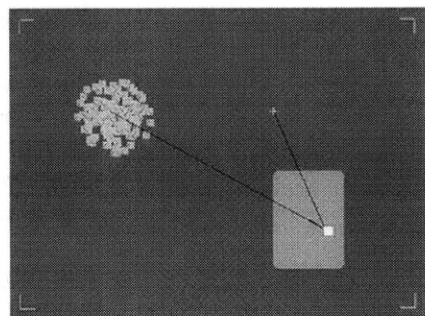
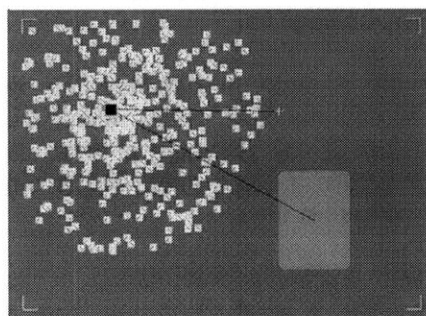
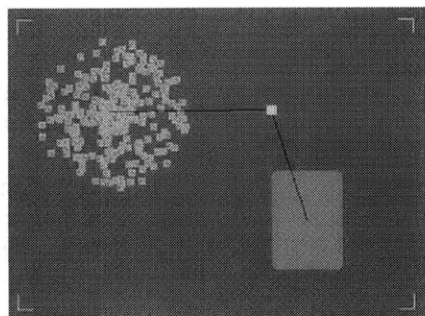
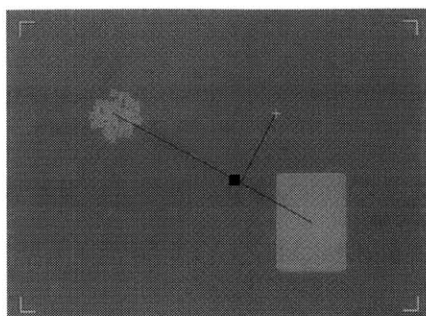
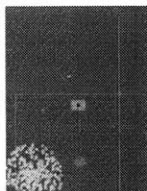
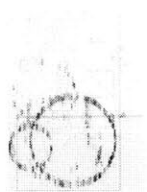
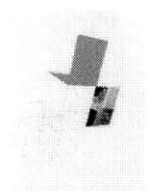
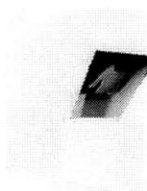
Location: int x, y coordinate positions (as this is a 2-D environment)
Size: int width and height
Color: int hue
Name: String name
Mobility: boolean toSink, toPlant, toWait
Water condition: boolean full



These values are discrete, in that they can be incremented or decremented. They reflect the state of the object at any stoppage of time. In other words they are a static snapshot of the object at any moment in time.

The object also maintains information of its dynamic state, that is what determines how it moves. This is not a discrete value but a function. Benjamin Fry of the Aesthetics and Computation Group at MIT Media Lab kindly lent me the code to what he has called the "Integrator" class. As he writes, "Instead of fixed values, the integrator is essential to the notion that these systems are in a state of flux. The systems exist within a continuous rather than discrete domain. Integrator values grow and decay rather than increment and decrement." (Fry, *Organic Information Design* p. 63-64) Each object has two integrator parameters, one that determines its changing x value (Integrator getCloseX) and another its changing y value (Integrator getCloseY). The important method of this class is the "attraction" method. This method applies a force to the object, moving it towards its intended target. This force is constantly changing as the object approaches its target. The function is :

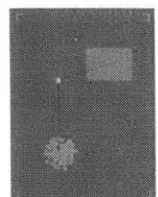
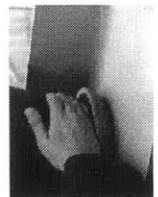
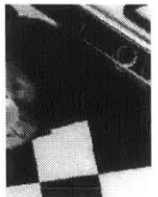
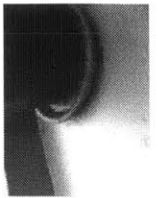

$$\text{Force} += k \text{ Attraction} + (\text{target} . \text{Value} - \text{value})$$


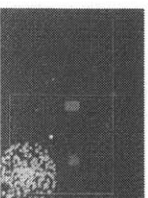
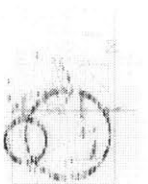
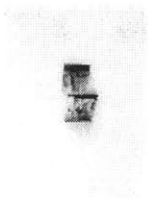


where "kAttraction" is a constant, "target" is the intended destination of the object and "value" is its or the destinations changing velocity. So the force at any given moment is the difference between the velocity of the destination and the object's velocities multiplied by a constant. The important point here is that the motion of the object is determined by physics, it will accelerate and then decelerate as it moves towards its target. If the target is moving it will likewise adjust its acceleration and deceleration according to the target's movements.

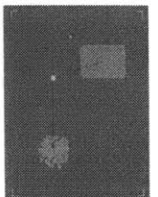
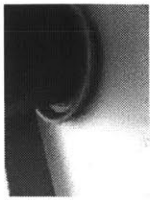
The simulation begins with the cup being empty (CE) and headed towards the sink to fill up. When the cup reaches the sink the sink turns wet (SID) to indicate it has water. When the cup is full it leaves the sink for the plant, causing the sink to go dry (SD). When it reaches the plant the cup begins to lose water (CW--) and the plant begins to gain water (PW++). The plant also begins to grow leaves. The cup may need to make a number of trips to the sink to refill before the plant has reached water fullness (PF). If the cup approaches the full plant (CF) or if it is in the middle of watering the plant when the plant reaches fullness (PF), the cup is rejected and sent to wait (WC). If the cup has water it will go to the sink, empty out, and then go wait. It will wait for a certain amount of time: the ritualistic weekly watering interval speeded up in the simulation to a few seconds. During this time, the plant has begun to go dry and loose leaves. When the cup has finished waiting for its respected time period it begins to water again.

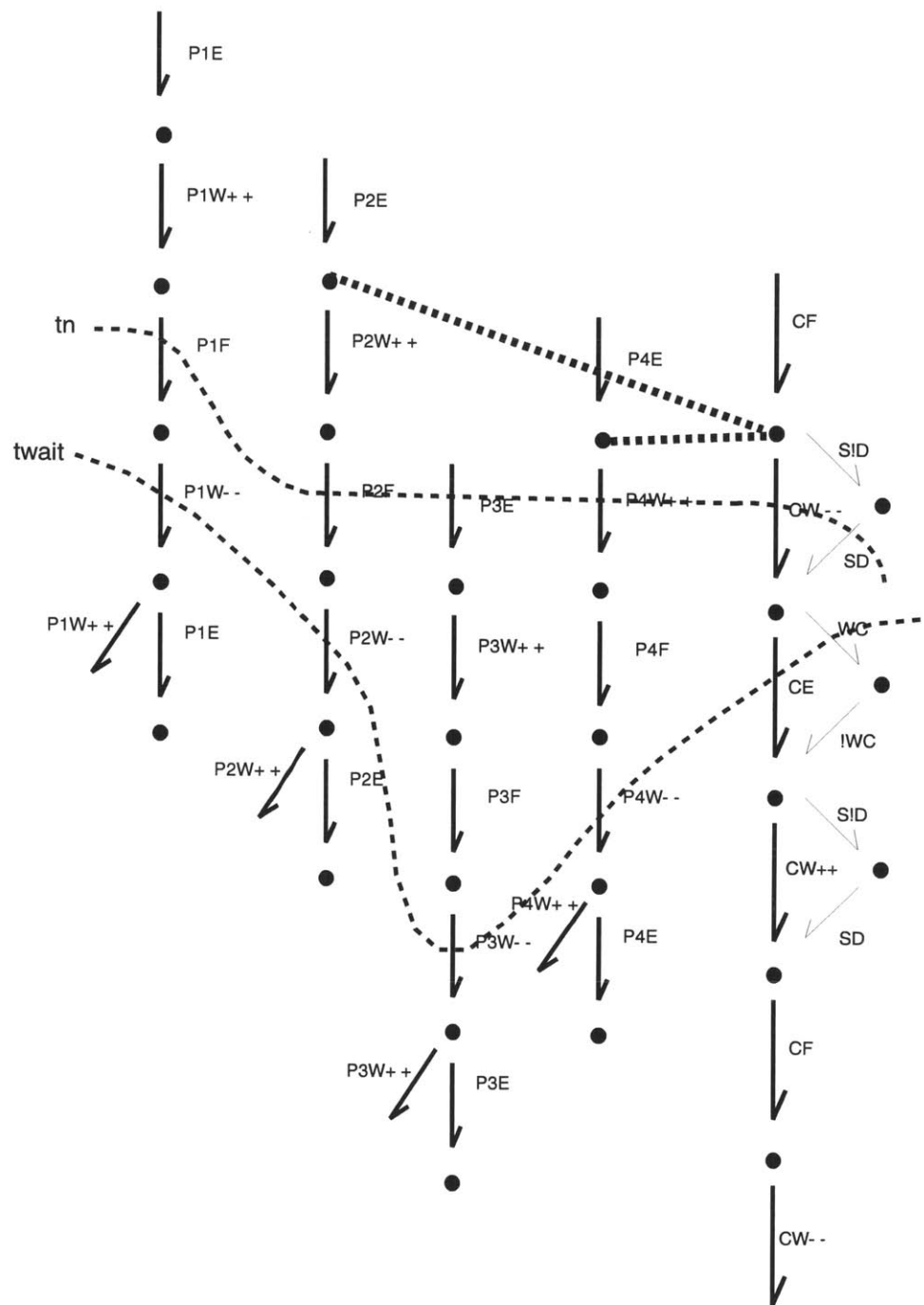
The waiting period is the roll of the die or chance operation for this game space. A random number between 0 and 25 is chosen which determines the amount of leaves that the plant will loose; the lower the number the smaller the loss. This randomness is necessary to simulate indetermina-





cies of weather (too dry, too humid) or any other factors outside of the system that could effect it. In addition to this there are forced functions like forced waiting or forced watering. Both are initiated by mouseclicking in their respective areas, the wait cross for waiting, and the sink for watering. These interactions with the game allow the user to play out different scenarios: too little water causes the plant to loose leaves while too much causes the cup to wait in turn causing the plant to lose leaves. The simulation is very basic. It is a set of causal relationships which have a handful of different outcomes. This doesn't maintain the user's interest for long since most of the possibilities can be understood by interacting with the simulation for ten minutes. However it does make the point that a complex system can be generated from simple rules and that these rules need not be directed at the entire environment but can be specific to a single object in that environment. The complexity of actions, in this case the believability that the simulation is an adequate representation of watering a plant, emerges from the cumulative effect of singular actions.





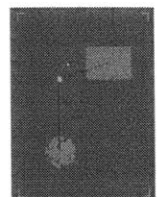
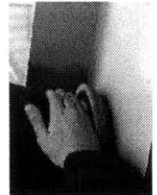


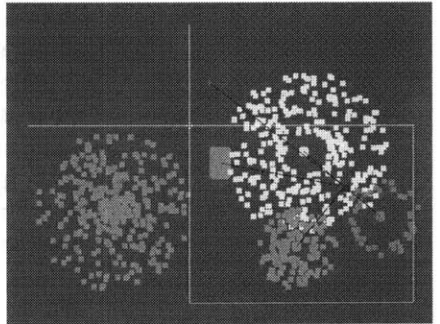
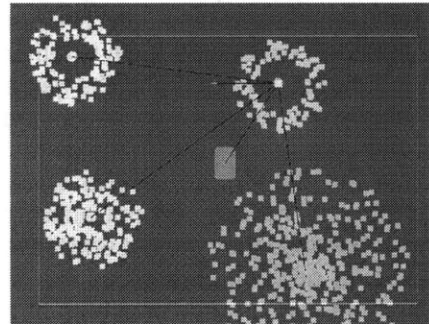
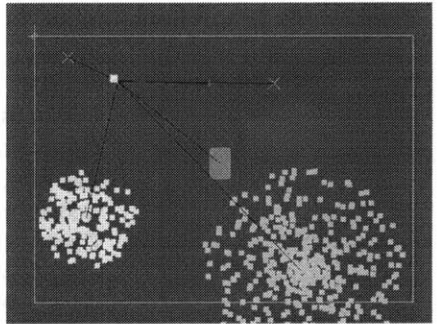
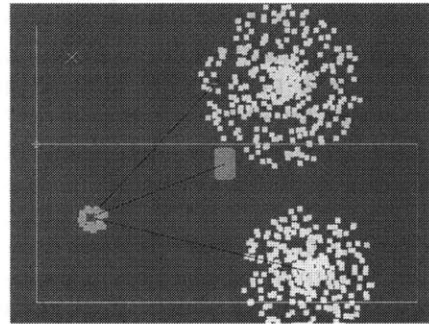
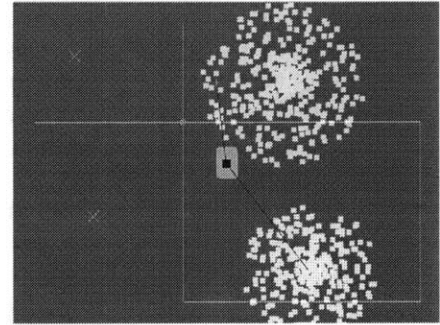
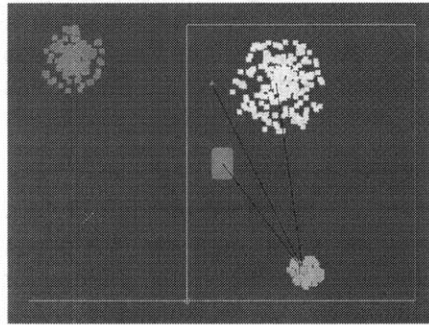
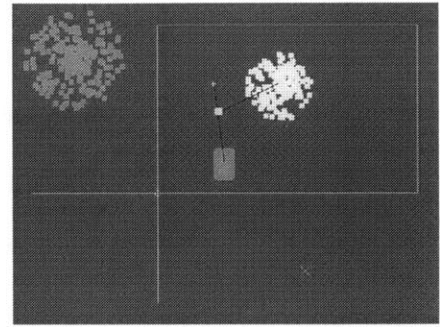
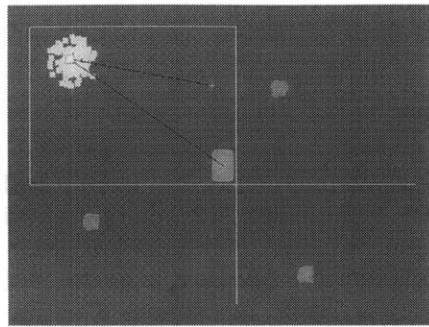
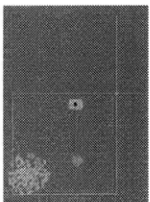
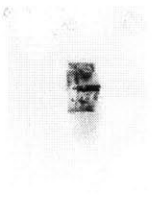
Simulation 2:

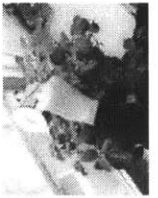
The second simulation looks at the game board as the instigator of the action. It divides the board into four and places a plant in each of the resulting quadrants. The active quadrant is the one that contains the cup and sink. To influence the simulation, the user can re-configure the quadrants as well as move the plants. To change the quadrants the user moves the point where the two lines dividing the game board intersect. The plants can be dragged to whichever quadrant one wants them in.



The behavior of the objects follows that of Simulation 1, but in this case there are four plants needy of water. What is the proper strategy for watering all the plants? Unlike Simulation 1, this simulation can entertain a variety of questions: What is the quickest way to fill the space with leaves? Will I need to sacrifice some plants to achieve that? How is my strategy affected if the plants are closer together or further apart? Because the user determines the internal time of the simulation, time becomes a heuristics. The occurrence diagram shows how this is the case. Each plant (1,2,3,4) occurrence diagram basically follows the pattern of the plant being empty (PnE), the plant gaining water (PnW++), the plant reaching fullness (PnF), the plant losing water (PnW--) and finally the plant being empty (PnE) or gaining water (PnW++) depending upon whether watering is re-initiated quickly enough. The game board as well as the cup activates these varying states, so that when the cup is full (CF) the plants, which are within the frame, can receive water (plant2 and plant4). A full cup will not activate plant1 and plant3 because they are not under the frame's influence. In addition time slices like t_n indicate the possible concurrency of events at a given moment in time, where P1 is full, P2 is full







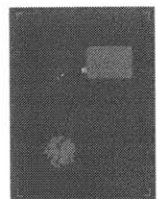
and under the frame's influence, P3 is empty and P4 is filling and under the frame's influence. As this example indicates it is the coordination of the frame and time-slices that constitute a workable strategy.



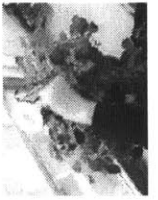
The system also has built into it, like most games, a chance operation that is triggered when the cup goes to wait. This operation suspends all other influences, cup and game board, on the growth of the plants and initiates a random water loss cycle across the board. t-wait indicates the time slice that results from this operation. An important aspect of any strategy would be to figure out how best to accommodate this chance operation. The reason this operation was included in the program was to upset the equilibrium that might result from following a particular strategy. Accidents and unforeseen occurrences would be represented by this operation.



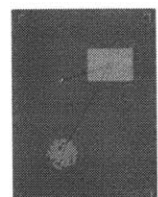
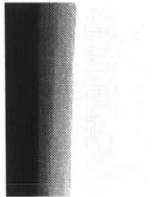
The purpose of the simulation was to correlate action with relations. Unlike the relation images of camera space, these relations are the basis for creating that action. So that an empty plant indicates to a full cup that it can perform a particular action, in this case lose water to the plant. The occurrence diagrams brought out the fact that objects have "states" that they must have knowledge of. Change in these states can be self actuated and/or triggered through communications(relations) with other objects. It is critical to understand that an action is an emergent effect of independent and relational behaviors of its component.

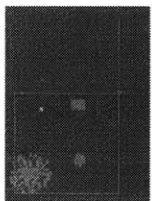






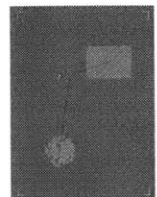
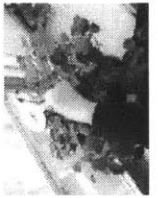
V. HYBRID MODELS

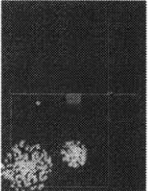


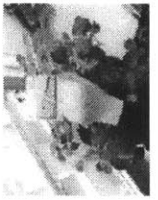


Space and time are the immaterial components of architecture. Their reciprocal relationship in each other's construction is difficult to understand through static architectural representations. By studying this relationship through other media and developing applicable models we can give form to these invisible structures. This research has looked at developing strategies for working with media that have time as a component of their expression. Narrative descriptions undertake space making through their telling or reading. Within the narrative static elements place objects and define locations, while mobile elements make trajectories that connect these disparate locations. Space is not the container within which all these elements exist but the product of their interactions. Camera space defines the container as the frame which determines a point of view or a field of influence. It can move, stay still, or jump around. Through it we record the actions between mobile and static objects. The frame also has influence over how we observe. When it moves it becomes part of the action. Game space helps to make the relationships between objects explicit. It is the play field for exploring combinations and potential systems. Time becomes a heuristic for the creation of alternate spaces.

These three mediums and the models created through them served as the basis for four hybrid models. These models used digital space as the synthesizing environment for combining the previous models.

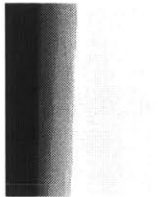




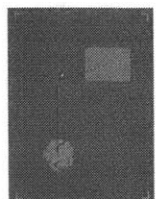
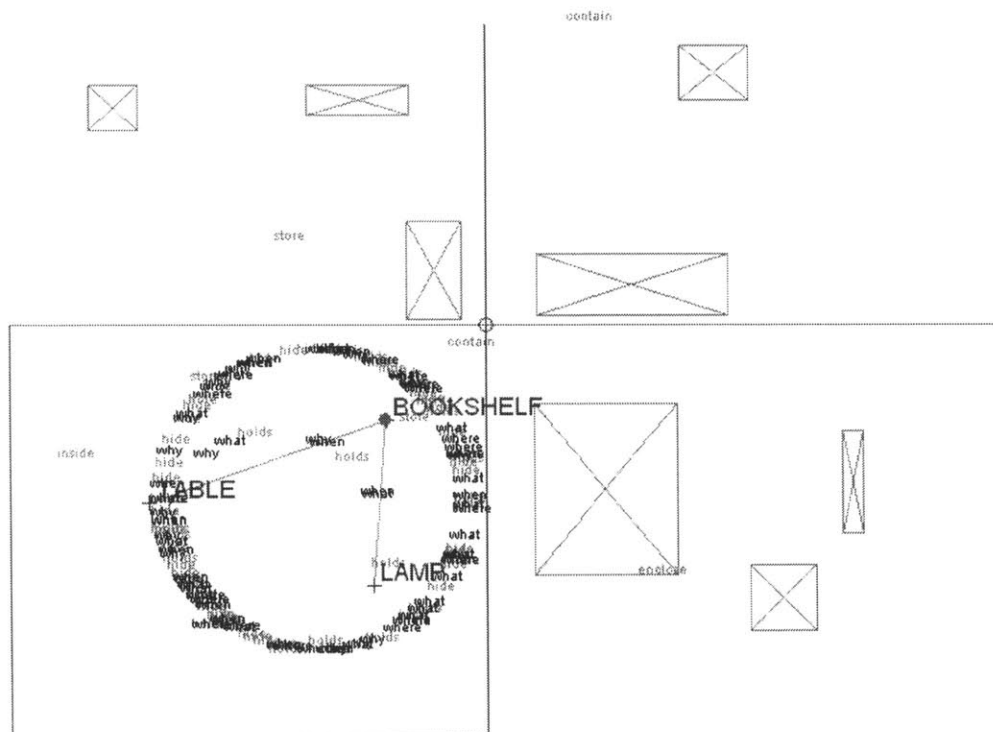


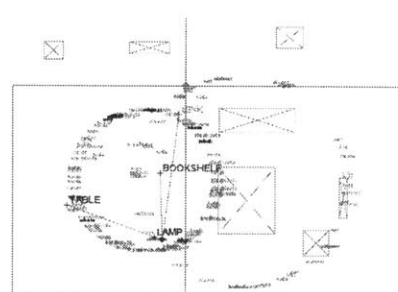
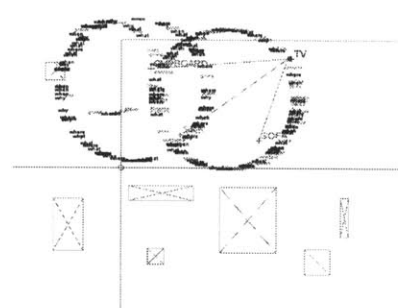
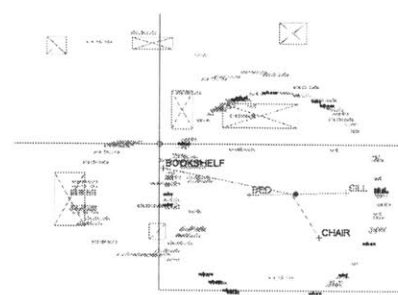
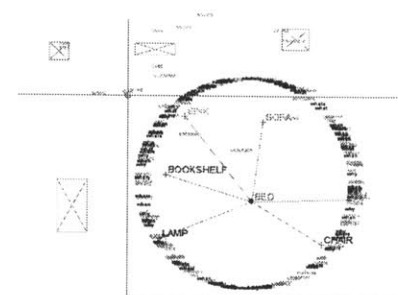
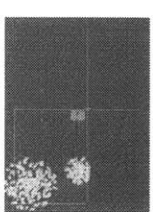
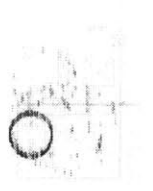
Model 1: Shifting Narrative Space

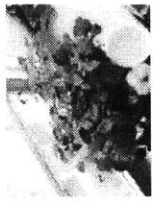
The role of the frame as the field of influence has caused it to be confused with the space itself. The frame is a device that concentrates the point of view. Space-making results from the influence of objects (static and mobile) on one another. The distinction between the frame and space is subtle but paramount. Take for example a generic room within which a speech is given followed by a reception. The space of the speech is distinct from the space of the reception. What is constant is the shape of the room which in this case would be analogous to the frame since it defines the field of influence.



Model 1 enacts the process of space-making by having an object (a cup) interact with other objects by querying responses from them. These



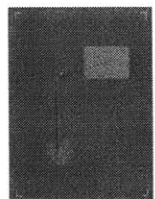


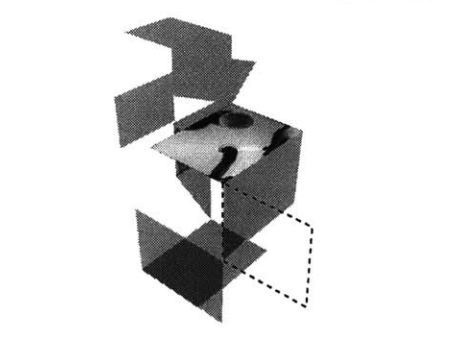
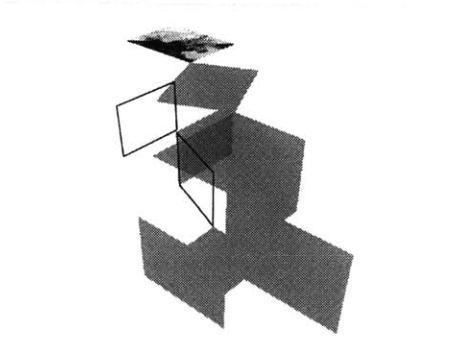
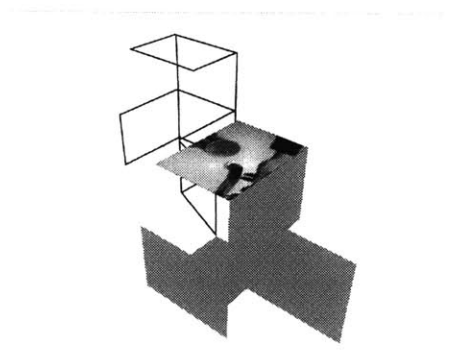
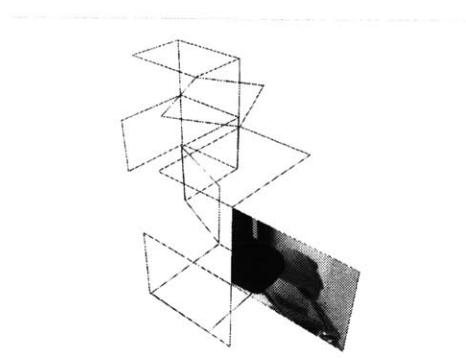


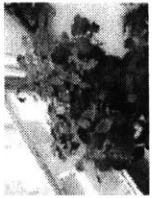
responses begin to define a circle around the interacting objects. The frame, which is able to be re-proportioned by the user, influences which objects can be queried. However, it is the momentary circles that define the space and not the frame. These circles are not only the boundaries of the interactions, but a direct result of the interaction. Like the space created between a handful of people conversing, the circles last so long as the interactions are maintained. Once the field of influence is altered, so that a different group of objects is framed, a new space is created.



At the moment the words are distributed randomly along the circumference of the circle created around the framed objects. They don't formulate a narrative, only a jumble of words which through some accidental overlap may create meaningful associations. Improvement on the model would require some form of narrative structure which would, on the one hand, convey the dynamic quality of the circles while on the other communicate a readable narrative. The disappearance of words while interacting with the model becomes an interesting means to revisit the idea of a thick description. Unlike the model in narrative space, this model would force the reading to be temporal on two levels: the time needed for reading and time that the text is visible to be read.

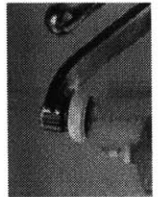




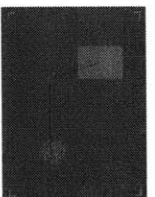
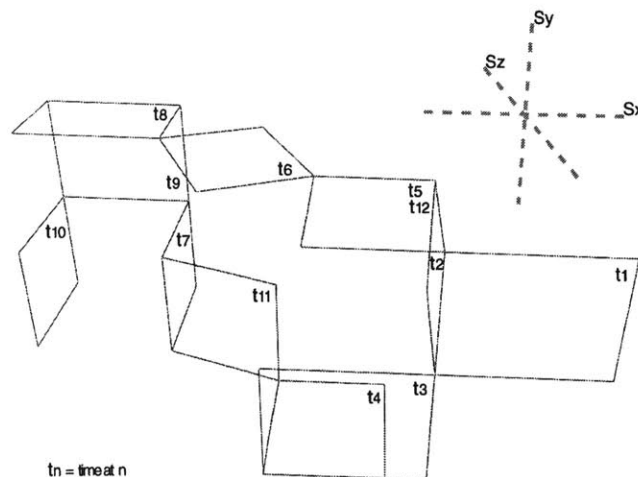


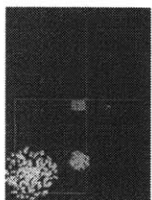
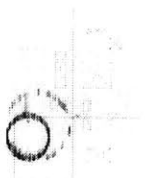
Model 2: Re-Framing Time

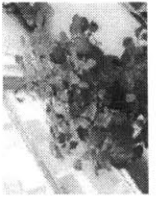
The “action montage” consists of eleven different points of view that begin at the faucet, move to the plant and return to the faucet. This model looked at spatializing the montage. Rather than reconstruct the actual interior architecture (the kitchen, its appliances, cabinets, etc.) the idea was to construct the architecture implied by the montage. Using a 150X112 pixel rectangle as the projection screen, 11 screens were constructed in virtual space. Their organization (above, below, parallel, or perpendicular) resulted from the different camera positions of the montage. Also, each screen was connected to another screen to maintain the montaging of the clip.



Having constructed the frames, the time montage was broken down to 190 individual frames each representing one tenth of a second of the movie. These frames were individually mapped onto the corresponding screens in the sequence they appear in the montage. Technically, each image frame is converted into a texture and assigned to its respective screen. As the program runs, its internal clock keeps count and calls on the particular frames to display themselves when their time comes. The result is that

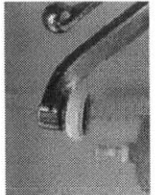




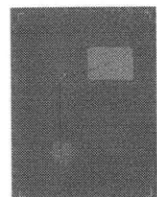
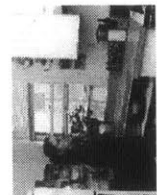


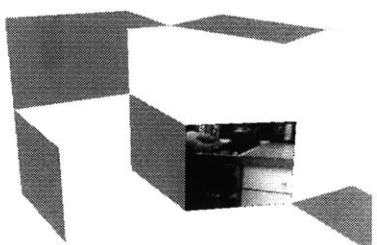
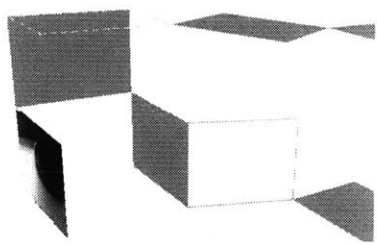
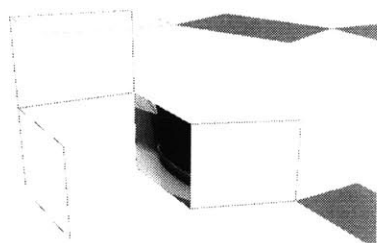
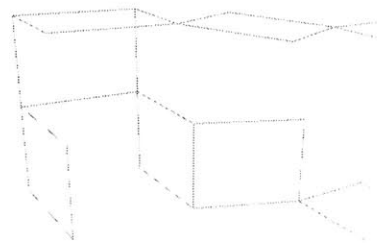
the montage film plays itself out within a 3-D environment.

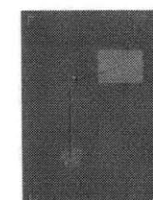
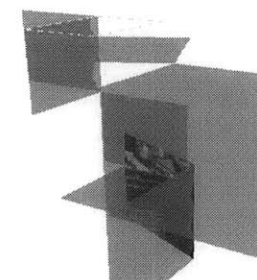
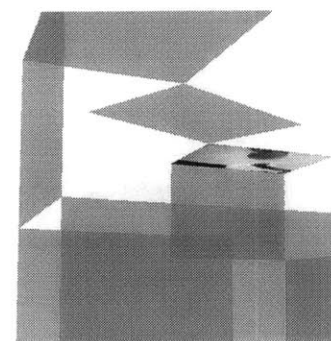
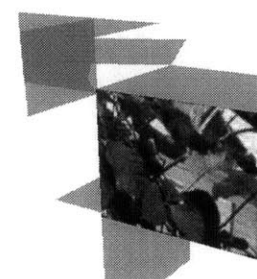
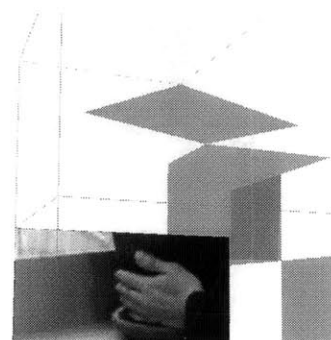
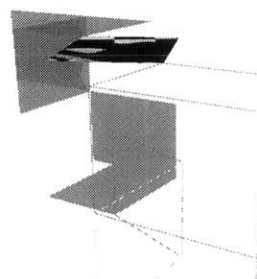
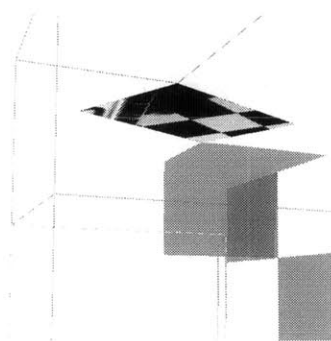
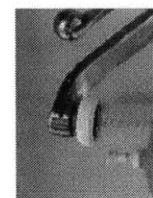
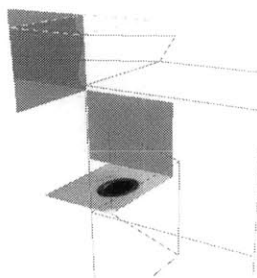
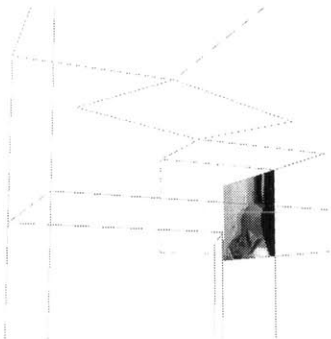
In addition to this, the program allows the viewer to manipulate the 3-D environment so that the point of view can change. This ability to change the viewing frame is another way to re-frame the time of the scene. The viewer is no longer a passive observer but an active participant in what he observes. He can view the event from above, below, or within.

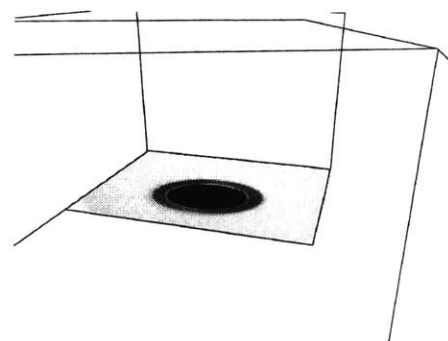
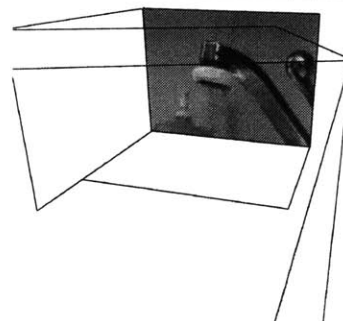
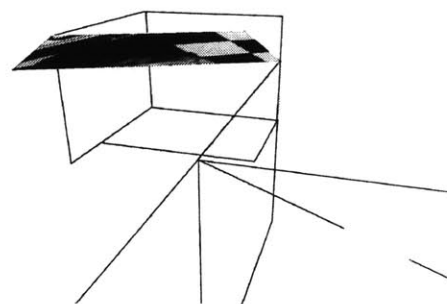
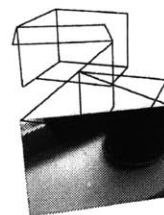
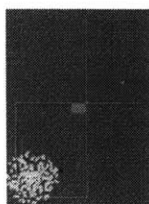


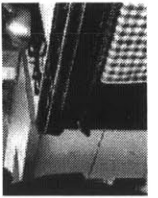
The viewer's ability to manipulate the viewing angle of the model opens up the question of whether the viewers can also influence the images they are viewing. Currently the shots play themselves out sequentially, moving from one end to the other and then back. If the viewer was able to select the path, then the resulting spatial configuration would be different each time a different path was chosen. This would require a different interface, which would allow the user to select a path from a set of options that could have many outcomes. A matrix filled with shots would be such an interface. The user could pick a series of cells following a trajectory through the matrix or they could pick a series of cells at random. In either case this selection would determine the number of screens and their corresponding shots. The ingenuity in the model would be its ability to re-configure itself into different spatial configurations based on the user's choices. Following the logic of above, below, and adjacent, each cell and consequently each shot would need to be tagged with an x, y, and z value. In addition to this the shots will need to determine how they play back in relation to other shots. Do they follow sequentially or do they occur simultaneously. This would require a time tag to be attached to each cell in addition to location coordinates. Since this model relies on action images as opposed to relation images, it would require that these images







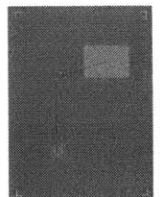
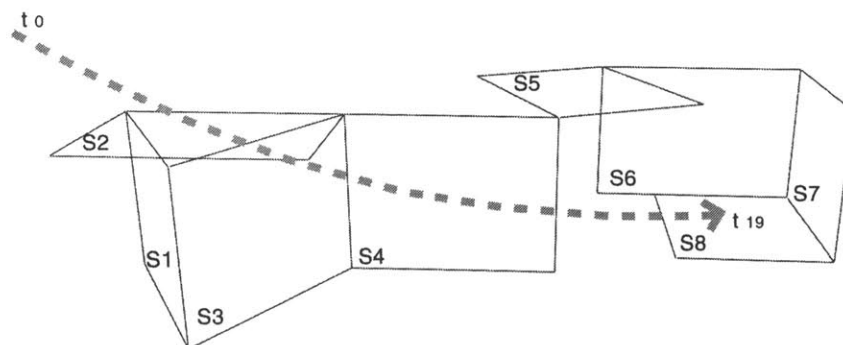
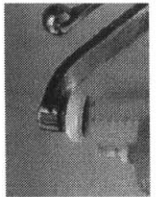


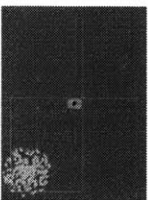
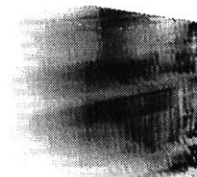
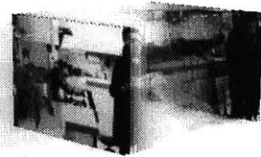
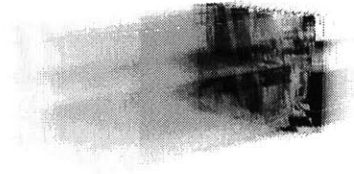


Model 3: Re-Framing Space

This model took the same approach as Model 2 towards the “relation montage”. Here there were eight different shots so eight screens were constructed. The difference, however, was that the montage was the equivalent of a “pan” that began at the plant and ended at the faucet, but that refused to engage the action. In a sense it was a spatial sweep from one node to another. This made the action aberrant and resulted in creating a unique path through the event which privileged the location as opposed to the mobile actions within the event space.

Similar to Model 2 the montage was converted to 190 individual frames that were mapped onto their respective screens. However, interaction with the model wasn't left to the user but instead a particular trajectory, similar to that taken by the camera, was enacted. The view begins at the plant and then steadily moves through the space in a straight line until it reaches the farthest screen. This animated travelling shot through a spatialized montage is a folding of methods over methods. The original montage is a result of camera methods and editing. The spatializing of the montage is a result of computation, while the animated traveling shot is a camera technique enacted by a virtual camera in a virtual space.

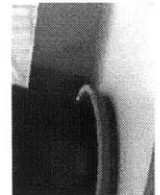
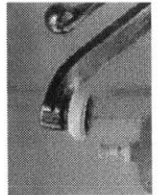




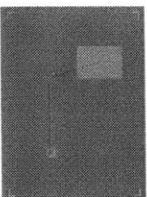
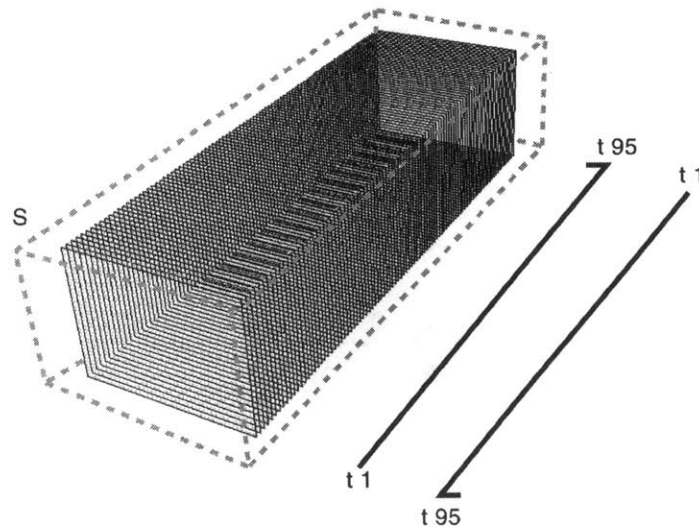


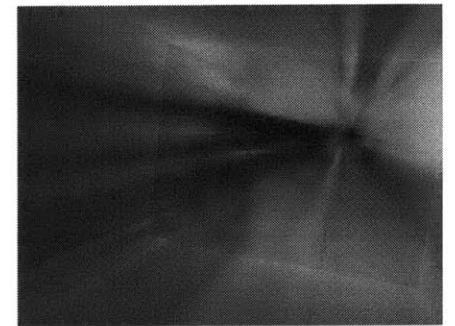
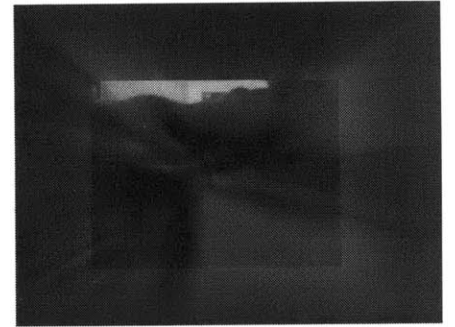
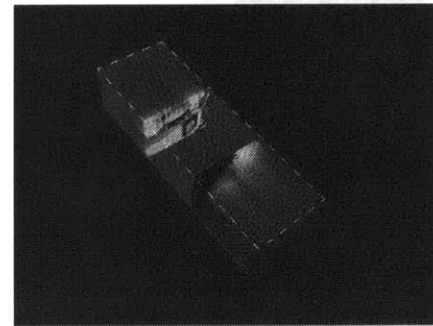
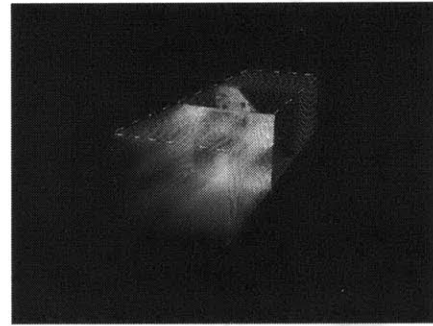
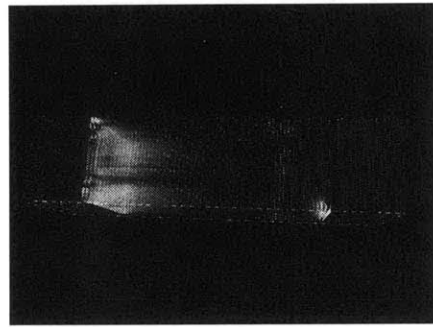
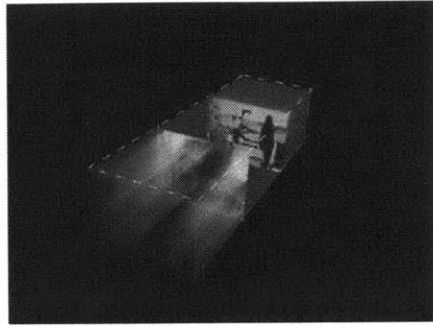
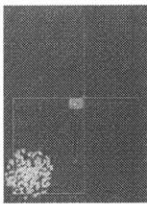
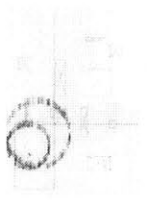
Model 4: Spatial Time

This model looked at the potential of creating the space of the event through a single action. Two depth of field shots, one looking at the plant from the sink, the other looking at the sink from the plant, were morphed to form the space. A depth of field shot combines all the actions of the event within the observation frame. Since both depth of field shots observed the event from opposite ends, what kind of space would result from the intersection of the two views? To observe this a 3D frame containing 190 screens was created. Each shot was allocated 95 screens, half the numbers of frames each shot contained (190). The shot would travel from its starting point to the other end and then return to its starting point. Although both shots would begin at opposite ends they would be synchronized in time. Each frame of the shot represents an instance of the space at that time. By projecting each frame onto an adjacent screen and leaving a trail of older frames decreasing in transparency behind, the new construction describes the space of the event as a residue of the action.

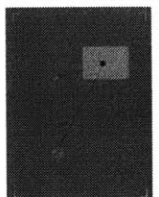
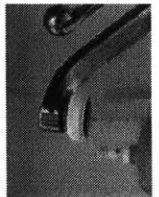


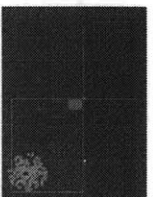
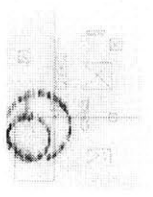
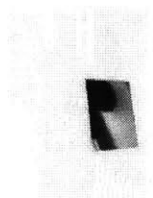
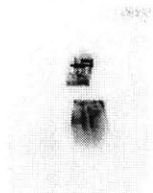
What is particularly unique about this model is





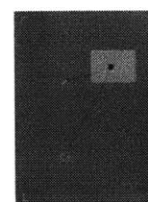
that it has found a means to represent space and time in a single artifact. Each frame of the movie is a time capture of the action. This is not so different from Muybridge's or Marey's motion studies. However, the frames also represent a capture from a particular point of view. By respatializing the frames the point of view can be altered so that we can view them from above, below, or any angle we wish. Compounding that with the dynamic quality of the model we can actually witness from different angles the formation of the event space by the action of the event.

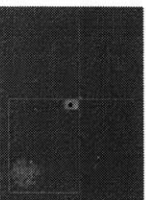
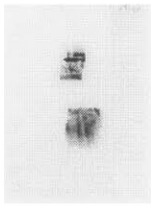






VI. CONCLUSION

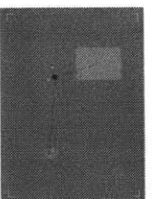
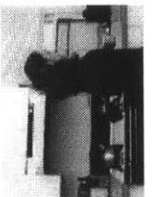
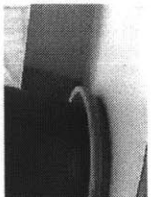
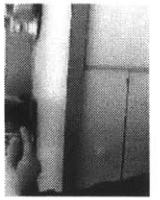


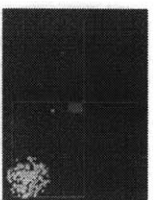
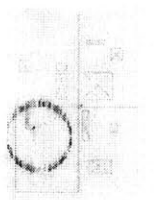
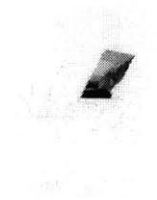
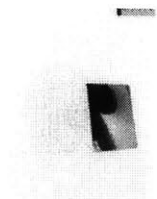
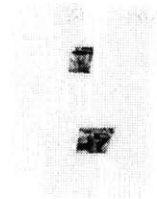


This thesis has tried to make the argument that new digital media as well as familiar old media can help provide the concepts, vocabulary and methods for making time an explicit component in the design of space. The research has pointed out that space should not be understood as a static unchanging entity but must be appreciated as a dynamic and evolving phenomenon. This may seem self-evident but architecture's concern with permanence has caused it to undervalue the temporary and ephemeral. This has entrenched it in a practice that is at odds with contemporary cultural and technological changes.

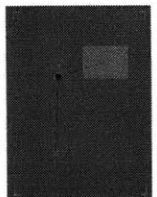
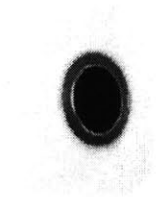
The role that new technologies and media, particularly information technologies, have played in reconfiguring our spatial environment demonstrates that architecture's historical role as space-maker is in jeopardy. What response can architecture have to online chat rooms, electronic work environments, intranets, extranets and the all pervasive Internet? One approach has been to populate digital space with simulated physical spaces. These virtual environments lack all the tactile and sensorial qualities of real physical environments as well as the dynamic and mutating qualities of digital environments. Their failure stems from their insistence on following a paradigm that privileges the physical environment over the digital. Another approach attempts to do the opposite by embedding digital technologies into physical objects to either enhance their use or create new hybrids. This approach seems to be more promising because the paradigms accompanying it realize the shortcomings of digital technologies. However the digital hype has created its share of insensitive incursions into the physical world, predominantly through electronic gadgets and toys that are overly complex and do not facilitate nor enhance our interaction with digital technologies.

This thesis attempts to define an area of research, which exists in the overlapping boundaries of physical and digital environments. It uses digital technologies to revisit physical space, developing methods for documenting and analyzing ephemeral phenomenon that are difficult to observe and





describe through existing passive media. The approach has been to give oneself over to the medium or technology and allow its operations to inform the methods for the research. What has become apparent from this attitude is that a medium's methods are not the same as its expression. It is true that in the hands of a master these methods do achieve expression but for the novice they are a means to experiment and learn. They act as a shifting frame of reference that re-contextualizes the problem. The novice, working in unfamiliar territory must figure out a way to reconcile the chosen method with the object of inquiry. It is in this uncertainty that invention occurs.





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